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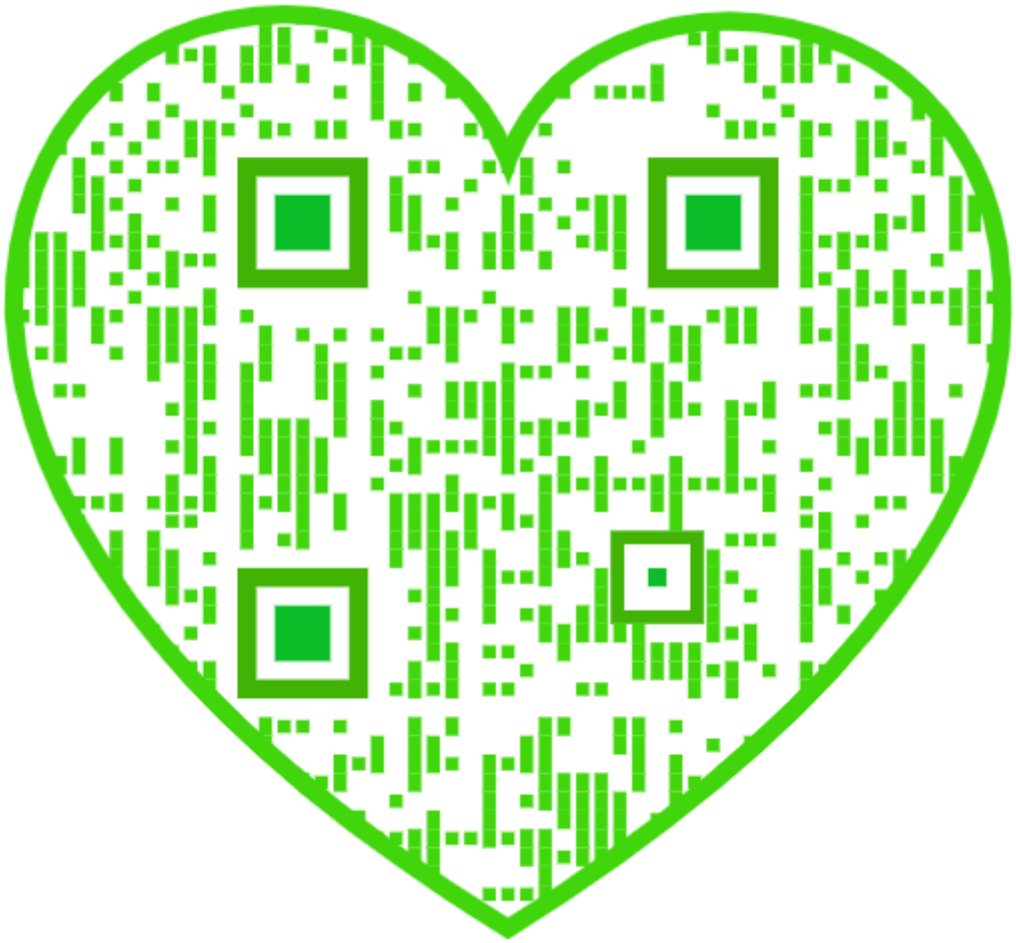

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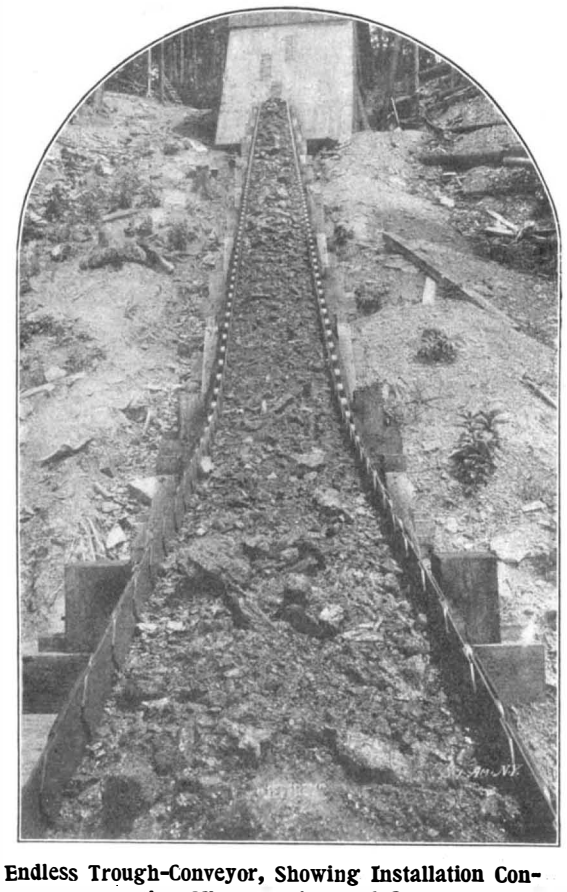
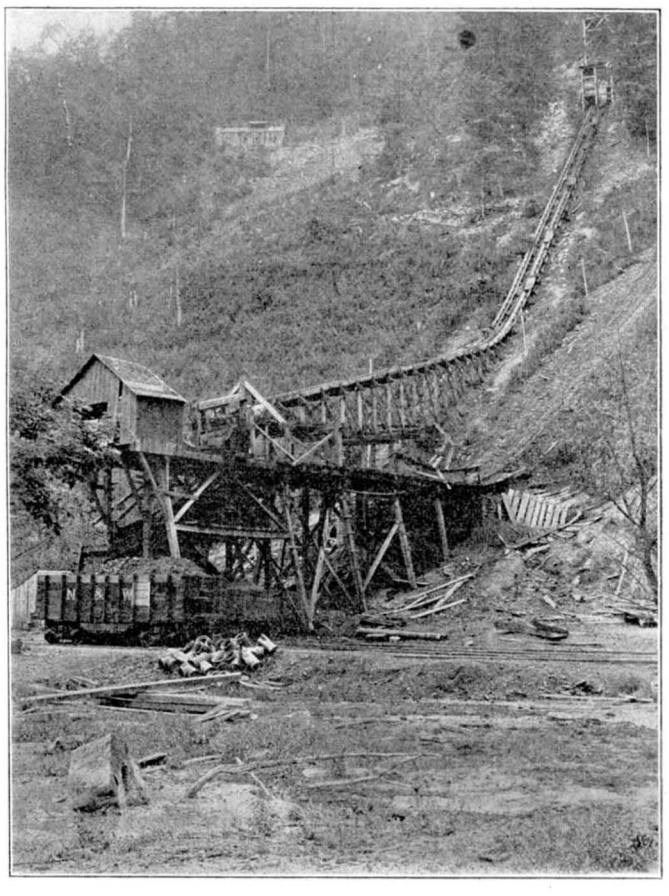
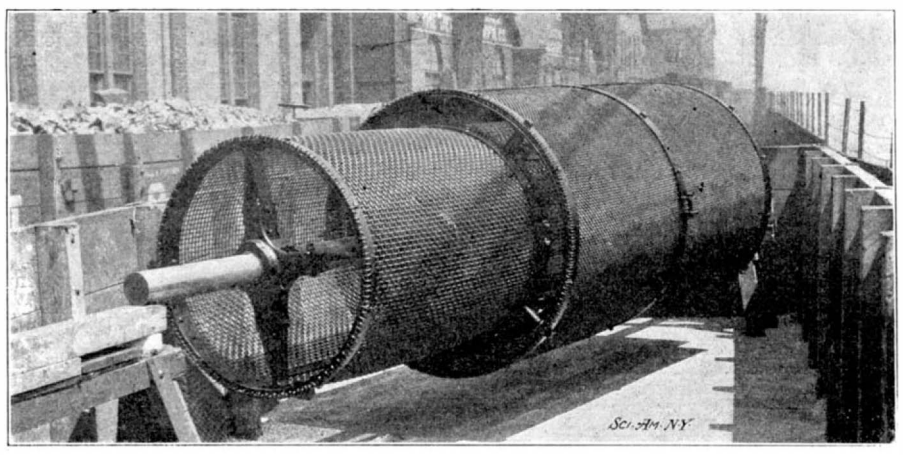


Endless Trough-Conveyor, Showing Installation Connecting Mine Opening and Cars.

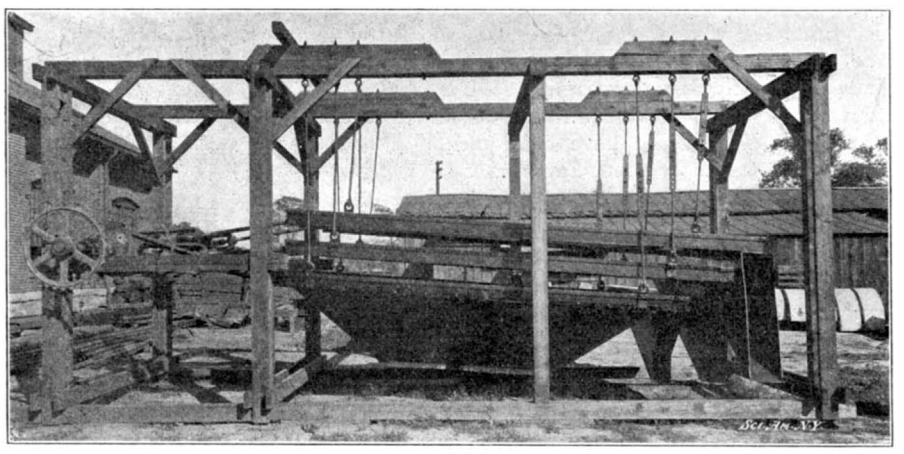


Bucket-Elevator and Conveyor with Automatic Loader.

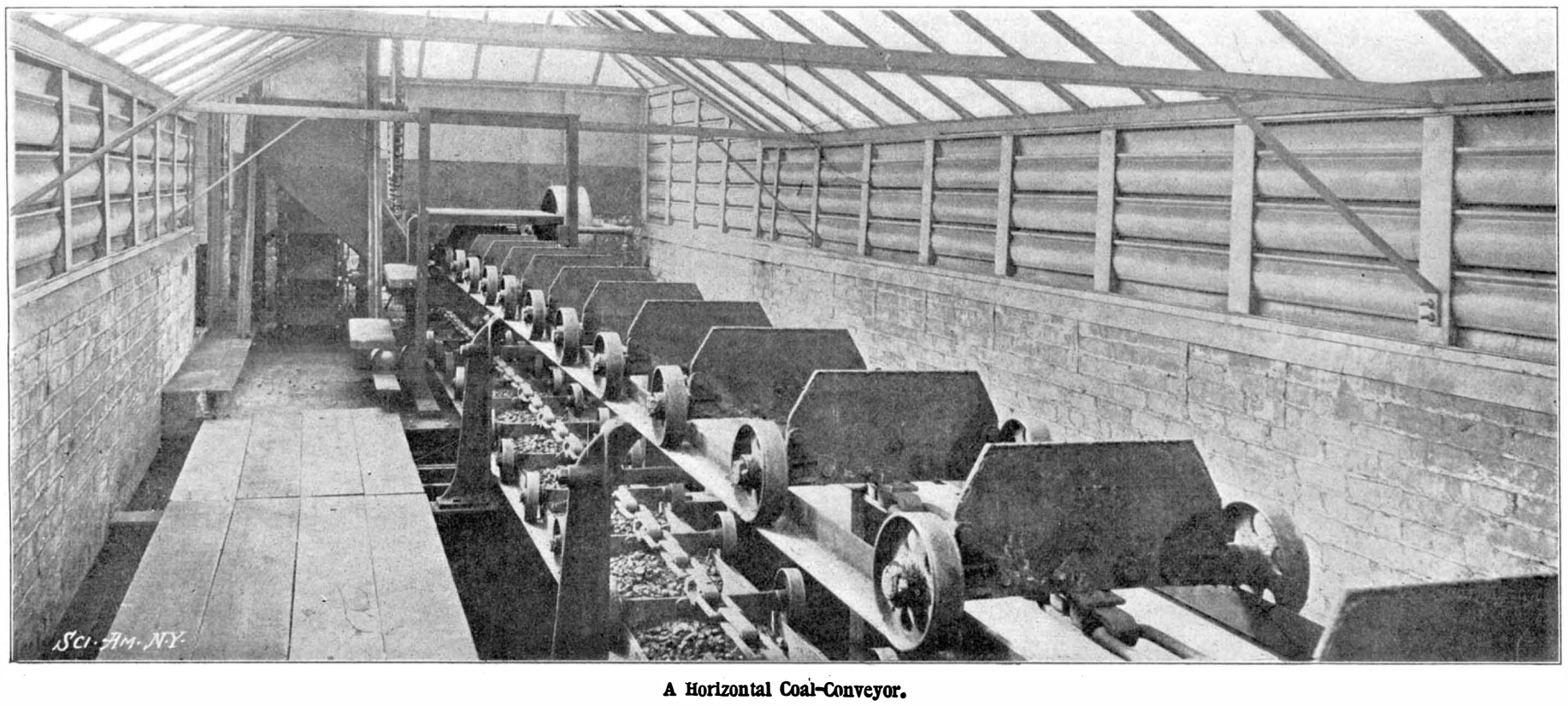
Vertical Bucket-Elevator and Conveyor with Automatic Loader.



Double Revolving-Screen.



Types of Shaking-Screens.



A Horizontal Coal-Conveyor.

AUTOMATIC MACHINERY FOR HANDLING COAL.—[See page 8.]

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NEW YORK, SATURDAY, JULY 4, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

UNIVERSITIES IN THE UNITED STATES AND GREAT BRITAIN.

Our English contemporary, Nature, in a recent article, makes a statistical comparison of the provision for university education in Great Britain and the United States, in which some truly remarkable results are shown. We were well aware before reading this article that in the wealth of their endowment, in the completeness of their equipment, in the numbers and qualifications of their professorial staff, and in the total enrollment of students, our universities were well ahead of those of the older country; but we were not prepared for such remarkable disparity as is shown in the article referred to. It seems that in the United Kingdom, with a population of 41,000,000, there are 25,500 university or university college students, or say five to each 10,000 inhabitants, while in the United States, with 76,000,000 inhabitants, there are 97,100 students, or 12.76 for each 10,000 inhabitants. After commenting on the important bearing which these facts must have upon the struggle for industrial supremacy, our contemporary proceeds to point out that the amount donated by private individuals for higher education in the period from 1871 to 1901 was eight times greater in the United States than that given for similar purposes in Great Britain; while, to say nothing of the income from state land grants, the amount provided by the state for higher education in the United States is six times as much as the government grants for the same purpose in Great Britain. In the older country there are but 13 universities and 20 university colleges, whereas in the United States there are 170 colleges with an endowment of over $100,000, and 49 of these have endowments of over $500,000, while three of them have an endowment of over $10,000,000. Even more significant is the fact that the value of the endowments of the institutions of higher education in the State of New York alone exceeds the total value of endowments for education raised during thirty years in the whole of Great Britain; while the same thing may practically be said of the States of Massachusetts and California. Perhaps the most striking comparison is that from which we learn that the total number of professors and instructors in universities and colleges, included in the list of the United States Commission of Education, is 17,000, whereas the number of day students in the university and university colleges of Great Britain is only about 20,500, so that there are almost as many university teachers in the United States as there are university students in Great Britain.

Of the many institutions of our country of which we are justly proud, there is none, surely, more splendid than our system of public school and university education. Even in Germany, of whose educational advantages we have lately heard so much, there are only 7.87 university students to each 10,000 inhabitants, as compared with 12.76 in the United States.

THE ALDERMAN AND THE ENGINEER.

When the present city administration came into office, it found two of the largest suspension bridges in the world in course of construction or about to be built across the East River, neither of which, unfortunately, could lay claim to architectural or æsthetic beauty. The first of these, popularly known as the New East River Bridge, was so far advanced that it was too late to make any radical changes designed to improve its appearance. Of the other, now known as the Manhattan Bridge, only one of the foundations was under way; and the new bridge commissioner, who is one of the foremost bridge designers in the world, took advantage of the backward state of the work to cancel the old design, which possessed no æsthetic beauty whatever, and drew up plans for a new structure, which has the double merit of possessing great architectural merit, and embodying features in its design and materials of construction that will insure its completion in a much shorter time than would have been possible under the old plan. Among other changes, the new design contemplates the use of steel chain cables instead of steel wire cables, and the greater speed of construction is due chiefly to the use of that type. Although at first sight this may seem like a return to an earlier and discarded form of construction, it is, as a matter of fact, a distinct advance in engineering practice; improved methods of manufacture, and the use of nickel-steel, render it possible to build a chain cable of the same strength as a wire cable, which will compare favorably with the former in point of cost, will weigh not so very much more, and will have the advantage—extremely valuable just now when there is such a call for improved communication across the river—of being capable of construction in considerably less time.

It was inevitable that such a bold and radical change as this should provoke criticism. The engineers who were responsible for the rejected design and also for that of the present East River Bridge, to say nothing of the contractors for the wire cables, could hardly be expected to look with a favorable eye upon such a sweeping change. In view of the inevitable criticism that would be provoked, the Mayor very wisely appointed a commission of three of the most eminent bridge engineers in this country to pass upon the new plans. They have recently returned a favorable report; and it would now seem the time is surely ripe to push forward this too-long delayed work to completion. Unfortunately the question of appropriations has to be determined by a Board of Aldermen, which, in spite of its distinctly lay character, has undertaken to criticise both the architectural and engineering features of the bridge, features upon which, in the very nature of things, it is quite unable to express an intelligent opinion. The Municipal Art Commission has passed favorably on the architectural elements of the bridge, which, by the way, were especially designed under its supervision, and the engineering features are indorsed by the leading bridge engineers of the day. The obvious duty of the Board of Aldermen is, then, to confine itself to its duty of voting the necessary funds for construction, and thus do its part toward hastening the construction of one of the most urgently needed public works of the day.

THE NEW ARMY RIFLE.

It is stated that during our campaign in Cuba there were no less than half a dozen different kinds of rifles represented in the American army of invasion. The fact that two entirely different types—the Krag-Jorgensen and the old Springfield rifle—constituted the main armament of our troops, the former being used by the regulars and the latter by the volunteers, was in itself a sufficient handicap to place our troops at a serious disadvantage, particularly when it is borne in mind that the weight, range, and rapidity of fire of the two weapons were widely different. Hence, it is encouraging to learn that the government has definitely decided to adopt the new army rifle of which we gave an illustrated description in the SCIENTIFIC AMERICAN of June 6. The new weapon is a most excellent piece, greatly excelling, as we showed at the time, the best of the existing military rifles on every point of comparison. It is shorter (only 24 inches long in the barrel), lighter, has greater velocity, greater energy both at the muzzle and at the longer ranges, than the Krag-Jorgensen, the celebrated Mauser, or the very excellent German military rifle. The new Springfield rifle is to be supplied to the regular army just as fast as it can be turned out from the government arsenal, which, if working at its capacity of 200 rifles a day, could supply our army of 60,000 men in about one year's time. The Krag-Jorgensen rifles of the regulars are to be passed on to the National Guard, and they will carry them until the regular army has been supplied with the new weapon, when the volunteers will be supplied with the new rifle in their turn. The advantages of arming the National Guard as well as the regulars with the same pattern of rifle, especially when it is such a magnificent weapon as this, are obvious.

THE GROWTH OF OUR FOREIGN COMMERCE.

The indications are that the foreign commerce of the United States for the year will prove to be the largest in the history of the country, the total imports exceeding, for the first time, a total of $1,000,000,000, and the exports being larger than in any preceding year except 1901. Taking the trade figures for the eleven months of the year, it is evident that when those for the month of June are added, the total exports will amount to about $1,400,000,000. The largest total commerce representing the imports and exports combined of any previous year was that of 1901, when they amounted to $2,311,000,000. During the first year of the century, our total trade amounted to $162,000,000. In 1850, it had grown to $318,000,000; in 1860, to $687,000,000, and in 1872, for the first time, it passed the billion-dollar line. In 1880 it had increased to $1,503,000,000, and in 1900 it first passed the two-billion dollar mark, the total being $2,244,000,000; while in the present year, as we have said, it seems likely to exceed $2,400,000,000.

A SHIP CANAL THROUGH SCOTLAND.

In addition to the two great canals which are likely to be built on the American continent at Panama and between the Great Lakes and the Hudson River, there is now under consideration, with the approval of the British government, a scheme for building a ship canal through Scotland, from the Firth of Forth to the Clyde, at an estimated cost of $50,000,000. This is not the first time that the idea has been mooted. The favorable topography of the country between the two great estuaries, coupled with the great advantages, commercial and military, to be secured by cutting this waterway, have naturally attracted the attention both of the British government, which has looked at the scheme from the view-point of its great strategic advantages, and of the capitalist, who has always been fully alive to the commercial facilities afforded by such a short cut from the North Sea to the Atlantic as would be provided by a Forth-Clyde canal. The British Admiralty is now constructing a great naval base on the Firth of Forth for the use of the North Sea fleet, and the cutting of the canal would at once double the strategic value of this base, since it would enable the fleet to reach the Atlantic by steaming a distance of only forty miles. Commercially, the canal would be valuable as opening up a direct route from the North Sea to Canadian and New England ports.

DESTROYING THE WATER HYACINTH BY A NEW CHEMICAL PROCESS.

During the last year experiments have been tried under the supervision of the government, with the idea of ridding the southern waterways of the hyacinth. As is well known, the variety known as the water hyacinth spreads so rapidly and has such a rank growth, in Florida and Louisiana, that it has seriously interfered with navigation and in some cases has completely blocked streams which had hitherto been available for the use of light-draft steamers.

The hyacinth has been especially troublesome on the St. Johns River, where various schemes have been tried to destroy it. One of the plans was to equip a steamboat with a propeller provided with blades having very sharp edges, with the view of cutting away the growth below the surface. It was believed that this treatment would cause the plants to die, but the benefit was only temporary. While lanes of open water were made by the action of the rapidly moving propeller, they were soon filled with the hyacinth and this scheme was abandoned. At some of the smaller wharves on the St. Johns, the growth has been so thick that it has been necessary to go out in boats and cut away with sickle and knife a large area, in order to allow a vessel to moor at the dock, while some of the smaller wharves have been abandoned, as the plant grows so thickly about them that a boat driven by quite powerful engines is in danger of becoming blocked in the midst of a bed, unable to extricate itself.

The method which is now being tried, however, seems to have solved the problem of how to destroy the hyacinth, and it is believed that if sufficient equipment is provided, eventually all of the southern water courses may be cleared of the pest permanently. A chemical has been compounded which has such an effect upon the plant that if it comes in contact with the stem or blossom these portions soon wither; but the solution is so powerful that it works its way down the stem, killing the root as well. Some of the ingredients of the chemical are known only to the inventor but a large quantity of acid is used in its preparation. The process of manufacture is very simple, the "laboratory" being placed upon a barge provided with two tanks each of which has a capacity of 5,000 gallons. Connected with the tanks is a boiler in which the ingredients are mixed at a high temperature produced by steam heat. The barge is of such light draft that it can be towed by the spraying boat if desired, but the latter is provided with three reservoirs each holding 3,500 gallons, which are filled by pumping from the barge. Pipes lead from the reservoirs to a steam pump which supplies the spraying apparatus. This consists of three booms. One extends directly in front of the vessel, being supported by a block and tackle attached to the bow deck. The others project from the sides of the vessel. The sprayers consist of hollow tubes which are perforated at intervals of about a foot and the holes fitted with miniature nozzles. The liquid is forced into the sprayers through lines of hose which are connected to the sprayers by couplings in the usual manner. The arrangement of the sprayers is such that the chemical can be distributed over a space 90 feet in width when the boat is moving. The boat containing the spraying apparatus is of the type of craft used on southern rivers, drawing but 4 or 5 feet of water. She is provided with very powerful engines in proportion to her size in

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order to drive her through the masses of hyacinths, and is so modeled as to offer as little resistance to the obstruction as possible. Her reservoirs carry a sufficient supply of chemical to cover about 100,000 square yards, and on a portion of the stream where the growth is not too rank, the steamer will treat this area of surface in a day. In places where the side sprayers cannot be utilized on account of trees or other obstruction, the chemical is applied to the plants by means of ordinary hose operated by members of the crew.

Such is the destructiveness of the solution that within a few hours after it is applied the withering process begins and microscopic tests prove that the liquid penetrates the growth below the water, killing the roots, as already stated. Portions of the dead growth which have been pulled from the bottom of the St. Johns where the treatment has been applied show that the effect of the chemical is to rot the fiber and disintegrate it to such an extent that it no longer offers resistance to navigation. The solution kills the seed as well as the plant, and efforts are made to cover as much space during the seeding period as possible. The work has been done under the direction of the United States engineers. A. W. W.

MARCONI IN ROME.

Perhaps in no other country in the world is the work of the investigator in fields of scientific inquiry so little appreciated at its true worth as in the United States. To be sure, the newspapers see to it that no discovery, which can be readily colored with mendacious splendor to attract the public eye, is allowed to go unacclaimed as the most revolutionary that has been made in a century. But sensational recognition is hardly the desire of any true scientist.

If Americans seem cold, other nations on the contrary seem more than warm in their praise of scientific work. The opposite extreme of extravagant admiration in the form of popular demonstrations seems often to be reached in the southern countries of Europe. Not the least striking example of the heights to which the enthusiasm of a warm-hearted race may soar in its appreciation of the brilliant scientific achievements of one of its members, is afforded by the greeting accorded to Marconi on the occasion of his recent visit to Rome. We are as fully convinced of the greatness of our nation as Italians are of the glory of theirs. Yet, what American scientist or inventor was ever welcomed at a railway station by a deputation of city authorities and by a multitude of cheering countrymen? Still, such was the reception of Marconi in Rome on May 1 of this year. Not only the students of the colleges shouted an Italian welcome to him; but little school children seemed carried away by the popular fervor, and added their voices to the outburst of their elders. Not even a heavy downpour of rain could check the Italian ardor. The horses were unharnessed from Marconi's carriage, and men fought with one another for the honor of dragging him to his hotel. If the Italian papers are to be credited, his journey through Italy must have been a veritable triumphant procession. Indeed, the glamor of his presence in Rome waned only on the arrival of Emperor William, but soon regained its brightness after the departure of the Kaiser. At a special session of the City Council of Rome and in the presence of his family, Marconi was made an honorary citizen. In the great hall of the Campidoglio, reserved for kings and the highest dignitaries, and in the presence of the King and Queen and of a gathering composed of the foremost scientists and of Rome's aristocracy, he read a paper, seven thousand words in length according to his own statement, on his work in wireless telegraphy. The next day the Mayor drove him to the wireless telegraphic station on Monte Mario, where telegrams of congratulation were exchanged with other Italian wireless stations. Then followed a series of banquets at which orations were delivered, the chief topic being, of course, Marconi, who, it was plainly stated, was not only the most famous scientist of Italy, but even of the world. In a pretty speech, Marchesa Capranica del Grillo made him a member of the Italian Naval Institute in the house of Adelaide Ristori.

Much of this theatrical adulation, which to an American or Englishman is repulsive, can, of course, be explained by the effusive, emotional warmth which has ever characterized the Italian temperament. The feats of an Italian, be he scientist, soldier, poet, or painter, are generally viewed through a telescope and magnified out of all proportion. We are not prone to belittle what we have done in vanquishing other nations in the ceaseless war waged by commerce; we have not utterly disregarded the commanding place which we have lately assumed as a political power, and we certainly have not failed to impress upon our children something of the glory of American history. Yet, it seems quite beyond the power of the average American not only to award to his scientific countrymen that meed of recognition which is properly theirs, but even to remember their very names. How many Americans have ever heard of Langley and Remsen among living scientists, not to mention Henry and Marsh among those of the past?

It is hardly necessary to drag a scientist in his carriage to his hotel as if he were a prima donna; to wait upon him whenever he visits a prominent city, or to surfeit him with applause. Some encouragement, however, he surely deserves, and that encouragement should be given with becoming dignity and with somewhat more generosity than the richest country in the world, a country, moreover, which owes much of its wealth to the work of applied science, has been wont to bestow on its investigators.

AN ELECTRIC TRAMWAY OPERATED UPON THE LORAIN CONTACT BOX SYSTEM.

Some time ago a short section of street surface railroad operated upon the Lorain principle was laid down in this country for experimental purposes. The feature of this system is that instead of the current being supplied by means of a trolley and overhead wires, or the conduit, contact boxes are installed along the track at intervals of a car's length, so that the car always engages at least one of the contacts and receives the necessary current therefrom. The system was submitted to a nine months' test, but was never adopted by any company or municipal authorities, with the result that it fell into practical oblivion. Now, however, the town of Wolverhampton, England, is having its tramways operated upon the Lorain principle. When the town decided to convert its horse traction street railroads to electricity the overhead trolley system was adopted. One of the members of the civic authority, however, brought the Lorain system before the council, and although it was explained that this system would cost about $10,000 a year more to maintain than either the conduit or the overhead trolley service, it was decided to adopt it upon the condition that the Lorain company should lay down and maintain the test lines for twelve months, so that the authorities might study its operation and possibilities. If at the end of that period it had proved a commercially successful operation the council would then decide whether to adopt it or otherwise. In fairness, however, it was decided that the term "commercial success" should be taken in comparison with the overhead trolley system working under similar conditions, and the question of whether it was operated at an actual profit or loss during the year, was to be left out of consideration, since this is influenced to a very great extent by the receipts per car mile.

For the purposes of the test a section of about 11½ miles was converted at an approximate cost of $9,000 per mile, exclusive of the expenditure upon the track, which cost about $27,500 per mile, or a total of $36,500 per mile of track. This is more than what it would have cost to install the overhead trolley system, but less than the expense entailed in laying conduits.

The Lorain company have completed the conversion and the street railroad is now on trial. At first the plea that the contact boxes between the tracks would be a source of danger to pedestrians and horses was raised. Cases of persons who had experienced shocks by treading on the boxes while crossing the thoroughfare were at first reported, but when the matter was investigated these were found attributible to unskillful laying of the contact boxes. Col. Yorke and Mr. A. P. Trotter, upon their inspection of the first section of the line on behalf of the Board of Trade, drew attention to the projecting of the contact boxes above the level of the roadway and they condemned them in unmeasured terms as being at least undesirable. Mr. Trotter supplemented his report by raising the question of danger due to the mechanism in a contact box failing to act, that should the piece of iron which makes the electrical contact not fall after the skate has passed along, a man or a horse treading upon the block would in all probability be killed. However, no accidents arising from this source have as yet occurred and any defects which have presented themselves from time to time have been immediately remedied.

In the event of the system not commending itself to the council authorities of Wolverhampton at the expiry of the experimental term, the Lorain company will have to remove their contact boxes, and transform the cars so that they can be adapted for the overhead system, at their own expense. The cables have already been laid in case of such an eventuality, and thus the railroad could be brought into operation on the overhead trolley principle with but very little delay. At the present moment Wolverhampton is the only place in the world where the Lorain contact plate system is in use. Should the trial prove satisfactory and a financial success, it will be extended for another 11½ miles. Furthermore, once it has established its success in this case it will in all probability be adopted by other cities in the United Kingdom, as the trials are being followed very closely by the leading municipal engineers. Up to the present the system has proved highly successful, but no reliable data as to its operation, cost of maintenance, and working will be forthcoming until the termination of the experimental year.

THE UNION ENGINEERING BUILDING.

A formal organization of the joint committee representing the various bodies which have taken action with respect to the gift of one million dollars of Mr. Andrew Carnegie for a union building, was effected on the evening of June 18. The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Engineers' Club have taken final action and appointed their representatives upon a joint committee for accepting this gift. The American Institute of Mining Engineers has likewise taken action in so far as its rules permit. Its council has appointed representatives subject to changes in the rules of the organization, which have been proposed by the council for adoption at the next general meeting. At the present time a letter ballot for ascertaining the attitude of the members is being taken, which shows an overwhelming majority in favor of the plans proposed by the council.

The American Society of Civil Engineers at its recent meeting in Asheville referred the matter to its board of directors for recommendation, and directed that the matter be then presented to the members of the society for letter ballot.

The joint committee was organized by the election of the following officers: Chairman, Charles F. Scott, secretary, Prof. F. R. Hutton. The chairman was directed to indicate to Mr. Carnegie the acceptance of his gift by the joint committee representing the several organizations.

The joint committee placed the immediate work of developing plans upon an executive committee of five, consisting of one member from each of the five organizations named in Mr. Carnegie's letter.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1435, opens with an excellent description by Day Allen Willey of the biological laboratory at Wood's Holl, Mass., the only institution of its kind in the United States. The article is well illustrated. A new discovery which may have far-reaching results in the field of scientific investigation and do much toward a further solution of the problem of the molecular construction of matter, was recently made by Siedentopf and Zsigmondy. The discovery is treated under the title "A New German Microscope." The rôle of nitrate and phosphate fertilizers in the richness of wheat in gluten is a topic which will doubtless be of interest to the scientific agriculturist. The Paris correspondent of the SCIENTIFIC AMERICAN describes in detail some of the Paris-Madrid racing automobiles, illustrating his text with clear illustrations. A. Dastre reviews discoveries which have been made in the field of cathode rays and Röntgen rays. Prof. Fleming's four Cantor lectures on Hertzian wave telegraphy recently read at the Society of Arts are to be published in the SUPPLEMENT. The first paper appears in the current issue.

BORELLY'S COMET.

A comet was discovered by Borelly at Marseilles, June 21, in right ascension 21 hours 52 minutes and 52 seconds, and declination —8 minutes 10 seconds. The comet had a daily motion at the time of its observation at Kiel of —7 minutes in right ascension and + 44 min. in declination. A nucleus and a tail were observed.

Prof. W. W. Campbell, of Lick Observatory, states that Borelly's comet was observed by Aitken on June 22, in the right ascension 21h. 48m. 6.4s. and declination —7 deg. 0 min. 49 sec. Prof. Tucker states that the comet was observed by Aitken, June 23, in right ascension 21h. 50m. and 51.4s. and declination —6 deg. 09 min. 26 sec.

On June 24 Borelly's comet was observed by Aitken in right ascension 21h. 49m. 52s.; declination —5 deg. 8 min. 48 sec. The comet was also observed at Carleton College Observatory on June 23 in right ascension 21h. 50m. 50s. and declination —6 deg. 7 min. 38 sec.

ALEXANDER MELVILLE CLARK.

It is with deep regret that we are constrained to announce the death on June 3, at the age of 54, of Mr. Alexander Melville Clark, of London, England, who for many years was the head of the firm of Messrs. A. M. & William Clark, and in that position acted in the capacity of our London correspondent. Mr. Clark was a man of marked abilities, and was widely respected and admired in his profession. He was greatly interested in the "Chartered Institute of Patent Agents," and was largely instrumental in introducing rules which have done much toward raising the standard governing the registration of attorneys in Great Britain. Mr. Clark was himself a Fellow of the Institute. He was a gentleman of sterling character and pronounced ability, and as one of the leading members of the profession his loss will be greatly felt, not only on the other side, but among those in America who have had an opportunity of coming in contact with his agreeable personality.

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THE TELECHIROGRAPH--A NEW FACSIMILE TELEGRAPH.

The most successful facsimile telegraphs which have been so far devised are based in principle upon the Gray and Ritchie telautographs, in which the movement of the transmitting stylus is resolved into two components, which after having been transmitted over two independent circuits, are reunited in a single resultant at the receiving station. In machines of this type chemically-treated paper is usually employed, which as it is acted upon by the current from the receiving stylus, is electrolytically decomposed to reproduce in facsimile the message, pictorial or written, sent from the transmitting station. An ingenious modification of these instruments is embodied in the "telechirograph," a device invented by Mr. E. Karl Gruhn, of Dresden, Germany. The accompanying photographs were made from machines brought to this country by Mr. Gruhn and installed in the offices of Mr. Thomas F. Fitzhugh Lee, who, with the inventor and Mr. Max Herzka, has undertaken to introduce the telechirograph in this country.

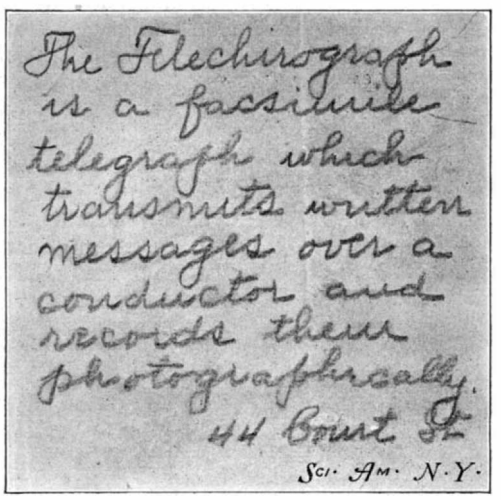
The Telechirograph is a facsimile telegraph which transmits written messages over a conductor and records them photographically.
44 Court St.
Sci. Am. N.Y.
the Telechirograph is a facsimile telegraph which transmits written messages over a conductor and records them photographically.
44 Court St.

Fig. 1.—An Original Message and Its Photographic Record.

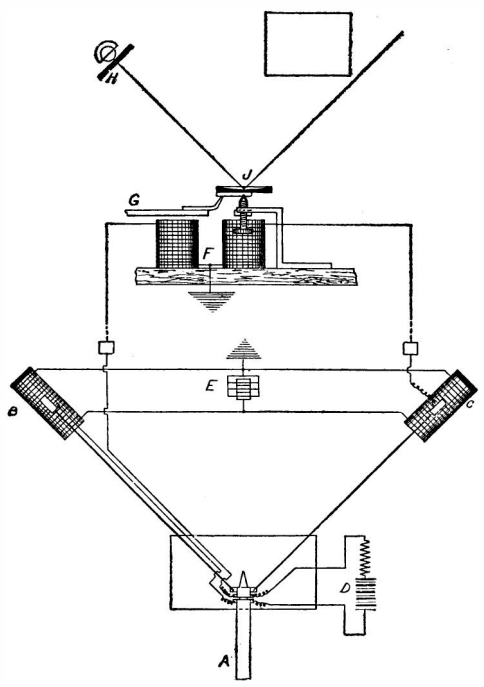

Fig. 2.—Diagram Showing the Principal Circuits of the Telechirograph.

The telechirograph differs radically from previous facsimile telegraphs in its method of receiving the message transmitted. Instead of employing chemically-treated paper upon which an unwieldy and cumbersome stylus is caused to act, a beam of light is utilized, which writes the message transmitted upon a strip of sensitized photographic paper. The striking photographic principle which characterizes the Pollak-Virag telegraph is here employed for an analogous purpose and with the same wonderful results.

Each instrument acts both as a transmitter and as a receiver. It is necessary therefore to describe only the operation of sending and recording that which is written. The message is inscribed on a piece of ordinary paper by lead held in the peculiarly-constructed pencil *A* (Fig. 2). By flexible connections the pencil *A* is caused, as it moves, to shift sliding contacts on their respective rheostats *B* and *C*. As the contacts reciprocate, the electrical resistance is varied, the amount of resistance cut out depending of course on the scope of the pencil's movements. Each of the two transmission lines forms a shunt on the local circuit of the battery, the currents changing when the contacts move along the rheostats, to influence two electro-magnets in the receiving station, by which electromagnets a small mirror *J* is caused to move, somewhat in the manner of the mirror of a Thomson reflecting galvanometer. A beam of light from a small incandescent lamp, *H*, is allowed to fall upon this mirror, after having passed through a system of condensing lenses mounted in a tube by which the rays are concentrated into a point. As the transmitting pencil writes, the mirror oscillates correspondingly, so that its beam of light, acting as a recording pencil, writes photographically on a strip of bromide paper, which is unwound from a roll, the message being developed in the box containing the operative mechanism.

A description of a few of the electrical details should not be without interest.

The coils of the rheostat are formed of insulated wire wound in the narrowest possible windings in contact with each other upon a non-conducting core, while the insulation in the path of the sliding contacts is removed from the surface of the spools, but in such a way that it remains between the single windings of the latter. Each winding, therefore, forms an element of resistance, and by the displacement of the contacts toward either end such elements are in number either reduced or increased. The mirror *J* is attached to a small triangular iron plate, one corner of which rests upon a setscrew, so that the mirror can oscillate in any direction. Beneath the other corners extend two armatures which produce the oscillations corresponding to the component movements of the transmitter, from the co-operation of which the previous motion of the transmitting stylus is obtained. The positive upward oscillations of the mirror are insured through the positive movement of the armatures of the electromagnet *F*. Permanent or steel magnets are used for the armatures of the electromagnets.

When not in use the pencil lies in a rest which opens a switch breaking both circuits—very much as the receiver hangs in a rest on the ordinary telephone, and by its weight opens the switch and breaks the current. When taken out of the rest the switch is closed and the current thus set in motion lights the small incandescent lamp in the receiving instrument. The apparatus is then ready for use.

When the message is completed the metallic pencil is put back in its rest at the transmitting instrument and the circuit is broken. In the receiving instrument the light goes out and an electric motor operated by an independent battery in the receiving instrument is set in motion. This motor operates a train of wheels or rollers which draw the portion of the paper written upon by the light ray through a developing bath and out again through a pair of rubber drying rolls so that the completed message is delivered about thirty-five seconds after the sender replaces the metallic pencil in its rest. The amperage and voltage used in the telephone will serve for the telechirograph.

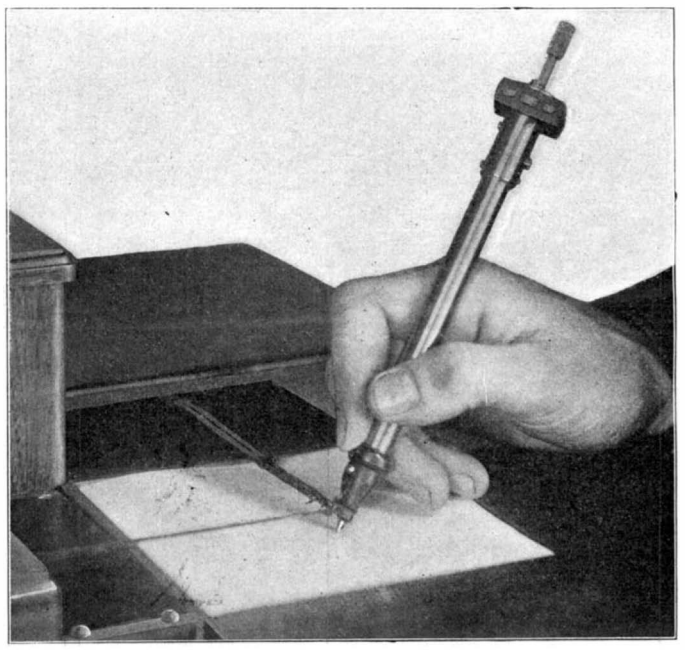

Fig. 3.—The Transmitting Pencil and Its Connections.

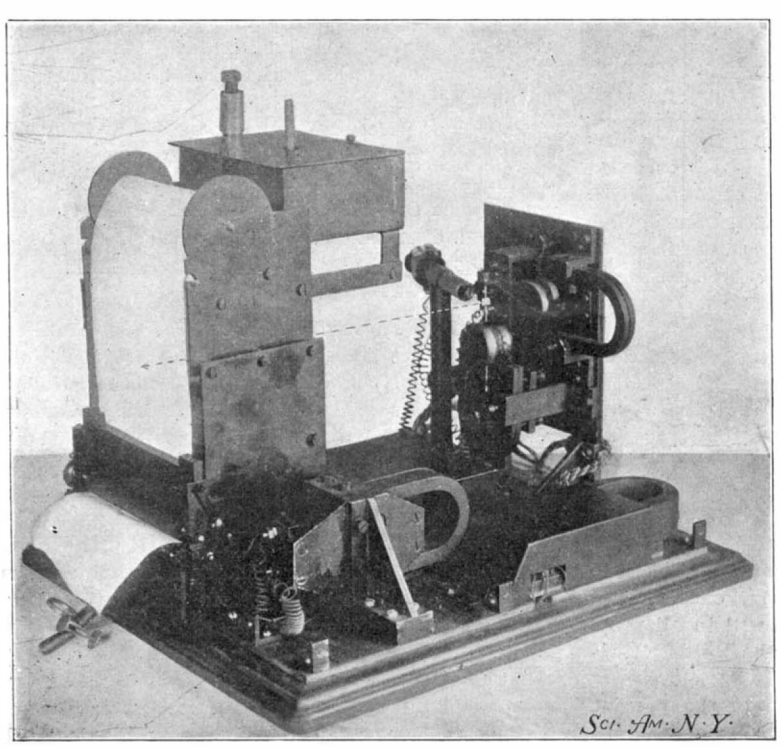

Fig. 4.—Operative Mechanism. Path of Ray is Shown by Dotted Line.

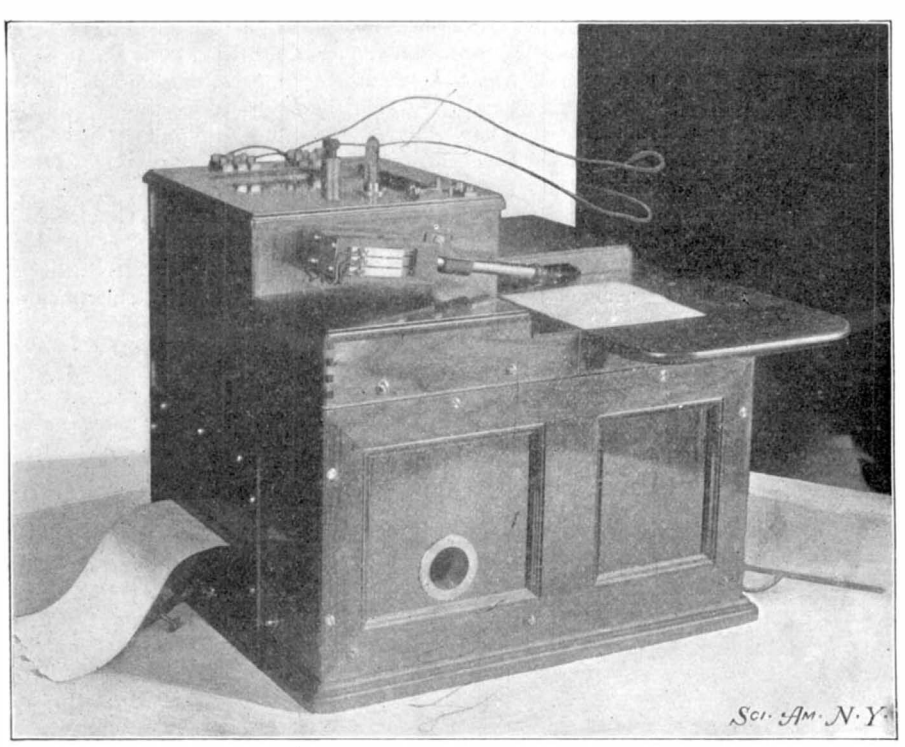

Fig. 5.—General View of the Telechirograph.

THE TELECHIROGRAPH—A NEW FACSIMILE TELEGRAPH.

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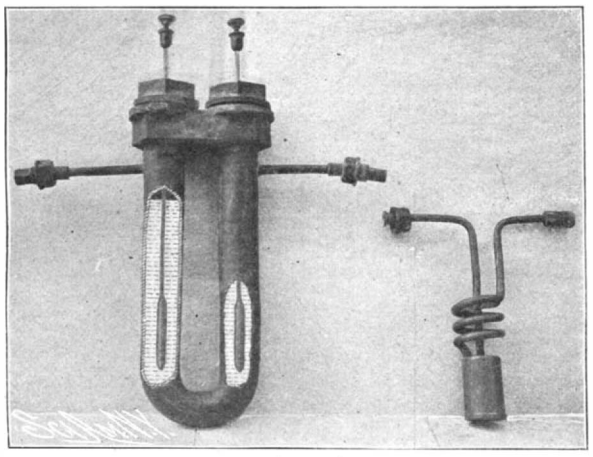
HOW LARGE STEAMERS ARE DIVIDED AND TAKEN THROUGH THE CANADIAN CANAL.

The construction of steamships and barges in yards on the Great Lakes, as is well known, has included a fleet built for the ocean as well as lake service. Some of these vessels are of very large dimensions, having a carrying capacity ranging between 4,000 and 5,000 tons, and equal in size to many "tramp" ships of the small class which are engaged in the Transatlantic trade. To bring these ships to the seaboard and through the Canadian canal system has required some interesting engineering feats; in fact, some ships are of such length that it has been found necessary to cut them into two pieces to allow them to pass through the locks of some of the small canals.

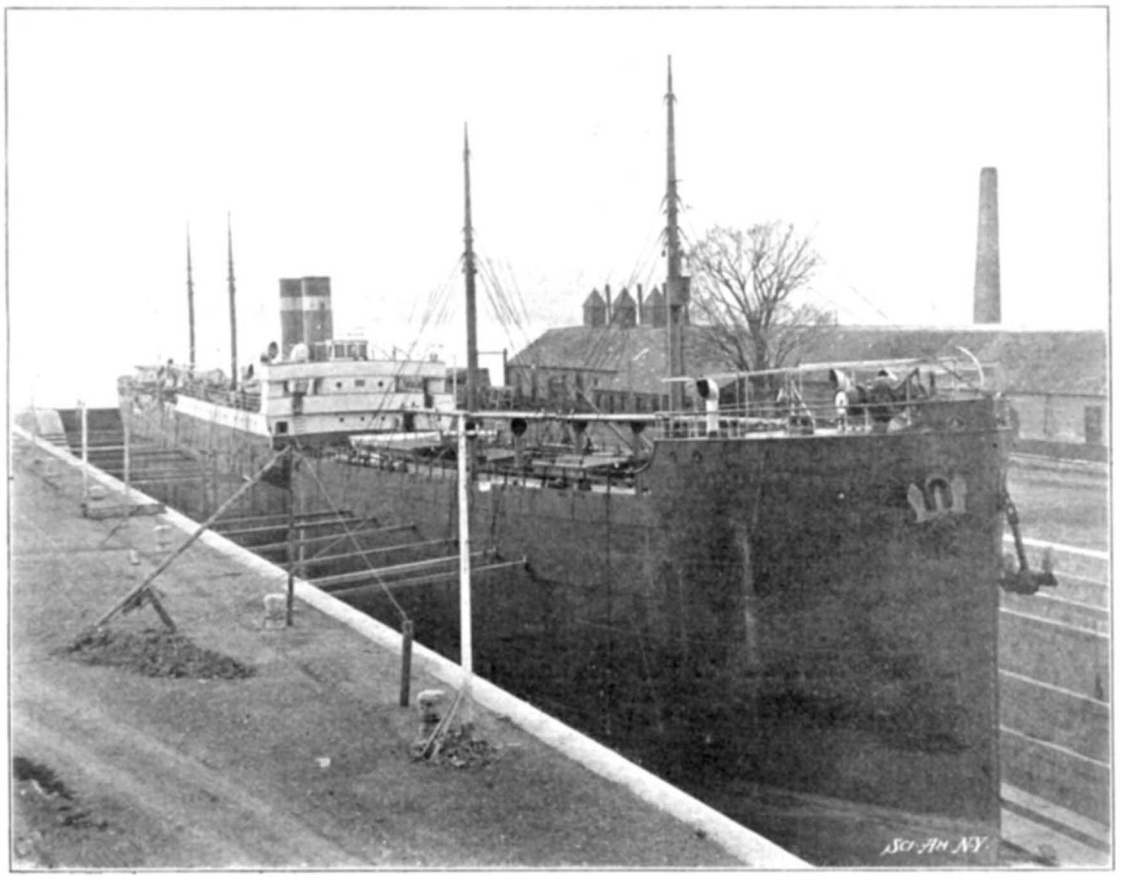


U-Tube with Electrode and Stopper. Worm Condenser.

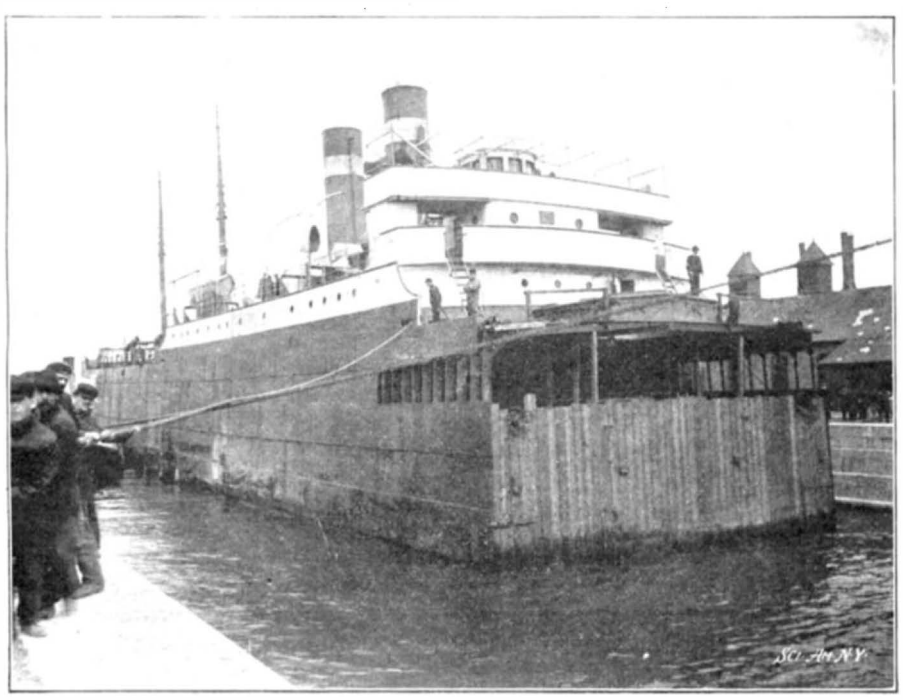
MOISSAN'S APPARATUS FOR THE ELECTROLYTIC PRODUCTION OF FLUORINE.

The American Shipbuilding Company at its Cleveland yard has recently completed several vessels intended for the American seacoast trade. As it was impossible to reach tide-water except by way of the Welland Canal and the St. Lawrence system they were planned with the view of being divided as stated. One of these ships, the "Minnetonka," recently made the voyage from Cleveland to the head of the St. Lawrence system. Here she was placed in a drydock and divided just forward of her engine room. The openings were filled with a bulwark composed of a framework of timber supporting heavy planks, the spaces between the edges of the plank being made watertight by caulking. The two sections were then taken through canals without difficulty, the rear portion being moved by its own engine and guided by the tugboat, the forward section of course being towed. In this manner the steamship was taken to Levis, Quebec, where the sections were placed in the drydock of Davie & Son and joined together.

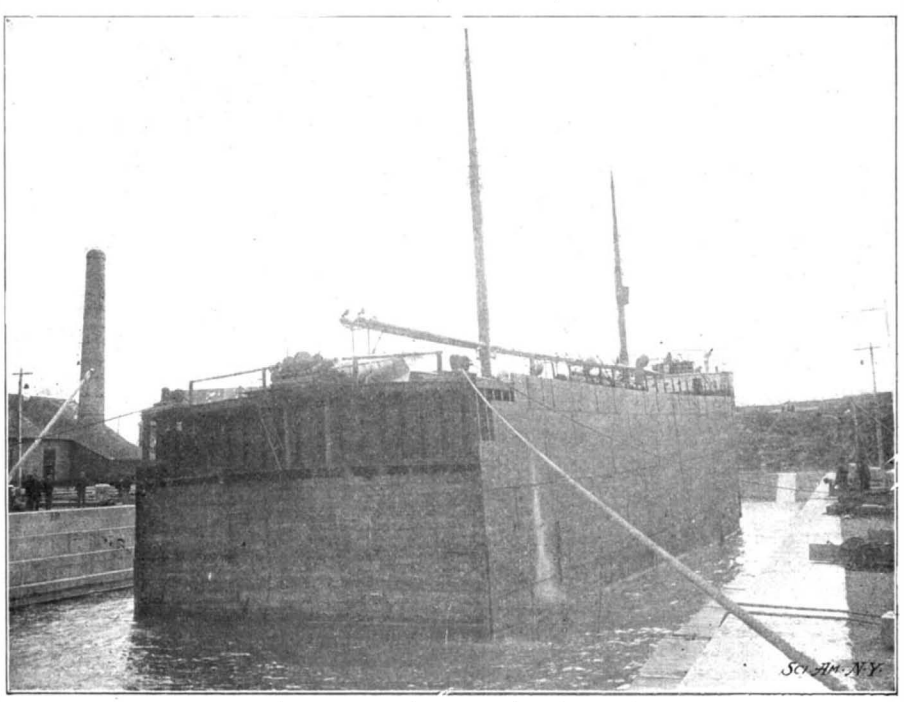
In constructing the "Minnetonka," the hull plates as well as ribs were planned so that the division could be made with comparatively little expense, and but a few days were required to join the parts of the vessel. Owing to the method of construction the re-united hull is as stiff as if it had never been cut in two. The accompanying photographs show the vessel in sections passing through the canals, and just after the shell was joined together in the Levis dock.



The "Minnetonka," Docked, With Her Sections Rejoined After Passing Through the Canal.



The After Section of the "Minnetonka" Passing Through the Canal.



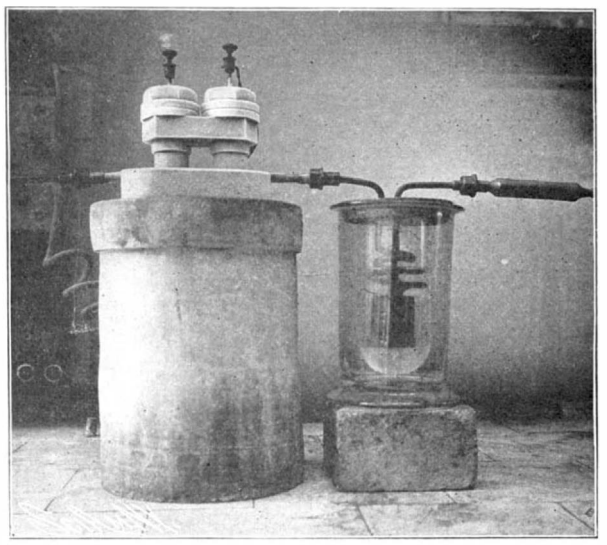
The Bow Section of the "Minnetonka."

HOW LARGE STEAMERS ARE DIVIDED AND TAKEN THROUGH THE CANADIAN CANAL.

PRODUCTION OF FLUORINE IN MOISSAN'S ELECTROLYTIC APPARATUS.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Although the existence of fluorine has been long established, it is but recently that this element was set free by Prof. Henri Moissan in the gaseous state. It has been since liquefied by using liquid oxygen, and solidified by liquid hydrogen. M. Moissan produces fluorine gas by the electrolysis of pure hydrofluoric acid, to which a small amount of fluorhydrate of fluorine is added to make it conducting. The electrolytic apparatus is illustrated in the engravings. The electrolysis takes place in a large copper U-tube. Each of the branches is closed by a screw stopper formed of a copper screw which is bored out and has fitted into it a cylinder of fluor spar. Through the latter pass the long platinum rods which serve as the electrodes. Fluor spar is used to insulate the electrodes from the tube, as most other bodies are attacked by the fluorine. The stopper closes the top hermetically by means of a lead washer placed between the head and the top of the tube. The electrodes are enlarged at the lower part so as to resist the action of the electrolyte for a longer time. At each side of the U-tube is a small platinum tube for taking off the gases which are produced at each pole. In the first experiments, M. Moissan used a platinum U-tube, but as this is quite costly he looked for another metal and found that a copper tube would answer very well, as it is but little attacked. In fact



MOISSAN'S FLUORINE LIQUEFYING APPARATUS SHOWING U-TUBE COVERED WITH FROST.

the fluorine which enters into solution produces a thin layer of an insulating fluoride of copper which thus protects the metal; but for this same reason copper electrodes could not be used, as the insulating layer stopped the passage of the current. The apparatus is placed in a vessel filled with chloride of methyl, which keeps it at a temperature of —23 deg. C. This is placed in an outer vessel containing fragments of chloride of calcium so as to surround the inner vessel with a layer of dry air, which is a bad conductor of heat. It was indispensable that the fluorine should be quite pure and free from vapors of hydrofluoric acid which might be drawn along at the time of its formation. To collect the vapors he uses a small worm-tube and condenser of platinum which is placed in a second vessel filled with chloride of methyl. Nearly all the hydrofluoric acid vapors are condensed here and remain in the lower part of the condenser, while any that might remain are absorbed by a series of platinum tubes placed at the end of the apparatus, containing pieces of melted fluoride of sodium which absorb them very energetically, and thus the fluorine gas comes out of the apparatus in a pure state. With a current of 50 volts and 15 amperes the fluorine is produced at the rate of 5 liters per hour, but the experiment cannot be made

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longer than 15 minutes at a time, as the apparatus heats up rapidly. He was, however, able to collect several liters of the gas at a time, which enabled him to make different experiments to show its physical and chemical properties.

When the current is passed, hydrogen is given off at the negative pole. At the positive pole the fluorine comes off as a seemingly colorless gas with a penetrating odor resembling that of chlorine and attacking the mucous membranes. The gas is very energetic and its chemical activity is superior to that of all other simple bodies. On account of its powerful affinity it gives rise to many interesting combinations with other bodies which often take place with flame or brilliant incandescence.

Fluorine is such an energetic body that its chemical affinity still holds good when in the liquid state, even at such a low temperature as —187 degrees. When a piece of sulphur is let fall in liquid fluorine it burns with an intense flame of a livid blue which fills the whole apparatus. The heat is so great that the vessel is broken. When the excess of fluorine has become volatilized, the glass is seen to be covered with crystals of hexafluoride of sulphur. The effect is still more violent in the case of selenium. When it is let fall in the liquid it produces a brilliant flame and explodes, shattering the tube containing the fluorine, and the vessel of liquid oxygen which surrounds it. The fragments of the tube are found to be coated with red selenium. Phosphorus burns in the liquid with a bright flame. With crystallized anthracene the action is very violent, with an explosion and a deposit of carbon. Arsenic also gives a bright flame. Carbon in the form of lampblack will combine with fluorine in the cold and is raised to incandescence, while wood charcoal takes fire spontaneously in the gas. Charcoal seems at first to condense the fluorine within its mass, then all at once it burns at a white heat and throws off brilliant sparks.

Gaseous fluorine was also studied as to its physical properties. Its density is found to be 1.26. The gas appears at first sight to be colorless, but when viewed in a tube 2 or 3 feet long it is found to have a marked greenish-yellow color, which is lighter than that of chlorine. Its spectrum was examined and found to have at least 13 rays in the red, from $\lambda = 744$ to $= \lambda$ 623.

AUTOMATIC MACHINERY FOR HANDLING COAL.

BY DAY ALLEN WILLEY.

The recent controversy in the Pennsylvania coal-mining region has probably aroused more interest in labor-saving machinery, not only for mining the coal, but for transferring it to the breaker and the railroad car, than ever before in the history of the country. Apparently it would seem as if the anthracite districts have not progressed as rapidly as the bituminous districts in the application of such apparatus, for a large amount of work is performed by hand which apparently could be more rapidly and economically accomplished by the use of machinery. The application of electrical drills and chain cutters has revolutionized the mining industry in some portions of West Virginia and in the bituminous collieries of western Pennsylvania, not only greatly reducing the expenditure for excavating the chambers, but allowing a much larger tonnage to be secured than where the ordinary hand tools are utilized. Tests with some of the electrical mining machines have already been made in veins of hard coal with, as stated, very satisfactory results, but in some cases their use has aroused such opposition from the unions that the mine owners desisted from installing them from fear of a strike. The principal forms of chain cutters and drills were fully described in these columns some time ago.

The improvements made in various forms of conveying machinery have reached such a point that this apparatus seems almost indispensable in the operation of modern anthracite as well as bituminous workings, although here the soft coal companies apparently have displayed more enterprise. A variety of forms of both elevating and conveying apparatus are now manufactured especially suitable for handling coal of all kinds. Several of what are known as the Jeffrey designs are herewith illustrated. One is known as the pivoted bucket conveyor, which consists of two long-pitch steel chains of the thimble type carrying a series of pivoted buckets arranged continuously. They are fed by means of a steel apron or belt actuated by the conveyor, so that the buckets can be automatically loaded uniformly without spilling. They are also discharged automatically by means of pairs of shoes operated eccentrically in the path of the buckets. The rollers at the end of each receptacle engage the shoe, thus tilting the former and allowing the material to pour into the receptacle.

Another system of conveyor is known as the endless trough. This conveyor is arranged with two strands of long-pitch steel thimble chain with self-oiling flange-rollers, the chain having attachments on one side, to which double-beaded or corrugated plates are belted; overlapping sides or ends are also provided, thus forming an endless open trough. The corrugations overlap one another, thus forming a perfectly tight apron in any position of the conveyor, whether traveling on a straight line, curve, or around the sprocket wheels at the end. These corrugations furthermore stiffen the plates, thus making it possible to use a much lighter steel than would otherwise be the case. The load, as well as the weight of the conveyor itself, is carried entirely by the flange rollers, which travel on a track, preferably light T-track. This type is especially suitable for transferring large quantities of material, and as the engraving indicates, can be installed for transferring coal from the mouth of the mine to the railroad tracks, while it could also be substituted for the car elevator in handling material from the mine to the top of the breaker by means of a special installation, as the receptacles are made as large as 5 feet in width and 12 inches in depth. By means of this system a continual service could be maintained from the mine opening to the top of the breaker if desired.

A method especially suitable for long distances, and which is now extensively used in handling coal, is known as the roller scraper conveyor. It is composed of a single-strand steel chain roller, the special feature of which is the rollers attached to the scrapers; the rollers traveling on an angle iron track placed beside the trough, also overhead. With this construction the friction, noise, and wear are reduced to a small per cent; permitting the use of a much lighter chain and other parts, besides requiring a comparatively small amount of power. The conveyor also travels upon shoes or wearing blocks in place of rollers where the installation of the latter may be inconvenient. The capacity of this form is the same as that where rollers are used.

A form of conveyor adapted for coal picking and sorting is known as the Century belt conveyor, which has been installed in a number of large plants for storing iron and other ores in the West. It consists of a continuous belt manufactured of very strong fabric and lined with rubber to resist abrasive action. The belt is supported on carriers of iron so arranged as to hold it in the form of a trough. It is provided with what is known as a traveling tripper, which by the pull of a lever will discharge the contents of the belt at any point and on either side as desired. As the speed can be graduated, broken stone and other impurities can be separated from the coal as it passes along the belt as readily as with the ordinary coal picker, while the arrangement of the belt renders the apparatus much more convenient as well as economical. It can be constructed in nearly any width, some of the larger ones at present in use extending four feet from side to side.

An improved form of screen which has already been introduced in some of the Pennsylvania mines is of the double revolving type, and is made with both an inner and outer jacket of cloth; it is constructed with a shaft running through the center, by means of which it is operated, the shaft being attached to cast-iron hubs connected in turn to wrought-iron arms and bands. A substitute for the cloth is perforated metal where the service required is unusually wearing. Another form of screen is of the shaking or vibrating pattern, and has been employed to advantage for separating the various sizes of coal. These screens are actuated by eccentrics provided with spring cushions, thus largely counteracting the jar. The eccentrics are set on thirds, so as to counteract the thrust on the building. The screens are usually constructed of a metal frame and either wire cloth or perforated metal of any length and width to suit the requirements. They are suspended from timbers or steel girders overhead by means of hanger rods. The latter are made adjustable at one end, so that the angle of the screens can be varied. Cars can also be loaded directly from the screens by means of an interesting labor-saving appliance which has been perfected. This is known as an automatic basket. As indicated by the engraving, it consists of two parts separating in the center, so that its contents can be released automatically into the railroad car or bin. It is suspended from overhead chains, which are attached to drums provided with a counterbalance. The basket is held in such a position that the coal from the screens is received by gravity. When filled, the basket is lowered automatically and discharged as indicated. In some forms they are emptied by opening an end and tilting the basket to the required angle.

Prof. W. J. Hussey, of Lick Observatory, who has been experimenting to determine the suitability of several high altitudes in Southern California for a permanent astronomical station, is said to have decided in favor of Mount Wilson, just east of Mount Lowe. Prof. Hussey will mount a 9-inch telescope on Mount Wilson at once for further experiments. An astronomical station was maintained on Mount Wilson several years ago by Harvard University. The atmospheric conditions there are said to be almost perfect for observations.

Correspondence.

A New Word—Phonologue.

To the Editor of the SCIENTIFIC AMERICAN:

I beg to propose through the SCIENTIFIC AMERICAN the word *phonologue*, meaning a message transmitted by telephone. The word will be analogous with telegram. *Telephone*, the word proposed by the telephone men, is too ambiguous. J. O. THOMPSON.

Secretary West Virginia Board of Agriculture.

Charleston, W. Va., June 15, 1903.

An Interesting Problem.

To the Editor of the SCIENTIFIC AMERICAN:

I would like you to explain the following phenomenon through your valuable paper, if you deem it of enough general interest to take the space. We have near here a telephone line across the Arkansas River, where ground is used for return. During the recent high water, this line was down in water for more than a hundred yards of its length, yet worked all right between the two stations, situated on opposite sides of this water-ground. The wire was new and galvanized, and could not have been insulated from water by rust. I do not understand why the current should pass this water-ground of practically no resistance to seek one that must have been of higher resistance.

Altus, Ark., June 10, 1903. D. A. ALLEN.

[The phenomenon described certainly appears to be remarkable, and is somewhat in line with others called to our attention at different times. A few weeks ago one of our correspondents stated that he found that a fence wire, to which a transmitter, a receiver, and battery were connected, worked very well for purposes of communication, although the wire was broken by a gate and roadway at a point located between the transmitter and receiver. Another correspondent wrote that in experimenting with a carbon transmitter and a receiver connected with a fence wire, he discovered that no battery was necessary, there being apparently a difference of potential between different portions of the wire sufficient to operate the receiver. While several theories might be advanced in explanation of these phenomena, none of them is altogether free from objection. The Editor would like to consider short communications from persons who may have explanations to offer or who know of facts analogous to those stated.]

The Chicago Drainage Canal and St. Louis Water Supply.

To the Editor of the SCIENTIFIC AMERICAN:

After reading the editorial in your issue of the 20th instant, in reference to the "Chicago Drainage Canal and the City of St. Louis," it occurs to me that your conclusions are not only well founded, but that other facts, with which you may not be familiar, still further justify the views enunciated by you.

In addition to your statement of the opinions given by various scientific men appointed to test the waters of the Illinois and Mississippi rivers (and on which investigating board, or commission, St. Louis was offered representation, but declined to avail herself of the opportunity) and the commissioners' idea that the bacteria and bacilli do not survive in running water more than about half the distance from Chicago to St. Louis, I would suggest that there are other reasons why St. Louis need have no fear of deleterious results from Chicago drainage; and one is that when the waters from the Illinois River reach the Mississippi, the latter stream. being much larger, confines the waters from the Illinois River to the eastern or Illinois side, and when the Missouri River is reached, the force of that stream, meeting the Mississippi about eighteen miles above St. Louis, and nearly at a right angle, the stream is again thrown to the Illinois side, and with such force that within the past thirty-five years the waters have washed away the bank until the river is now located about one and one-half miles farther east than at the date named, and it is continuing to encroach on the Illinois bank at the same rate.

That the waters of the Missouri River will be confined to the western line, in the short distance to the St. Louis waterworks—about ten miles below the mouth of the Missouri—hardly requires proof, but can be easily demonstrated when dry weather prevails and the Mississippi is clear, as the division-line between the waters of the two rivers (the Missouri being always yellowish or muddy, while the Mississippi is darker) can be distinctly noticed from the Eads bridge at St. Louis, demonstrating conclusively that the water obtained for St. Louis is from the Missouri River, as the current, or pressure, from that stream forces the Mississippi so far to the east that its waters cannot be reached from the St. Louis waterworks unless they locate their supply pipes more than halfway across the stream. C. E. GILLESPIE.

Edwardsville, Ill., June 22, 1903.

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A QUAINT DIVING APPARATUS OF THE EIGHTEENTH CENTURY.

BY C. FIELD.

The diver in his round goggle-eyed helmet, leaden-soled boots, and bloated-looking India-rubber suit, is a more or less familiar object at our great seaports, especially those which are the headquarters of the Royal Navy. The diver is a recognized member of the ship's company of every man-of-war of the present day, and a very useful person he is, well earning the extra pay which is bestowed on him when his services below water are required.

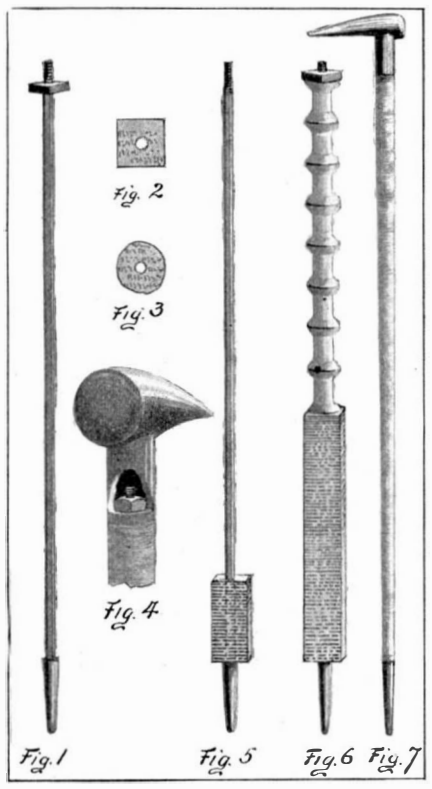
This, by the way, is not a new thing in one sense, for in the records of the Spanish Armada there is mention of a "diver" being sent from one ship to another. But this diver was probably only a man who was expert in swimming and diving, and not provided with a special diving dress enabling him to stay under water for long periods. Still, it would seem that there have been attempts to provide such a dress from very remote periods indeed. Old medieval manuscripts now and then give drawings of more or less impossible costumes directed to this end, and in many of them pipes to convey air from the surface to the diver's mouth are clearly represented. Probably, though, most of these were never really constructed or experimented with, and may rather be received as the author's ideals of what in his opinion might be invented. It was probably some contrivance of this kind that the famous Friar Bacon had in his mind when he asserted, as he did in his writings, that he could travel on the bottom of the sea with the same ease and safety as he could on dry land! A German, Francis Kessler, writing in 1617, describes what he terms a suit of "diving armor," showing that the necessity for protecting at least some portion of the body against the pressure of the water was beginning to be recognized. Again, there is a very "tall story" in Martin's "Philosophia Britannica" about a man down Devonshire way who invented some species of leathern diving dress which contained half a hogshead of air as well as himself. So successful was this invention, according to the above account, that he could walk about at the bottom of the sea, explore any wreck, and "deliver out the goods." He is stated to have carried on this business for a number of years, and amassed a large fortune thereby. But here in our illustrations we have what seems to have been a really practicable diving apparatus, which may well have formed an important step in the evolution of our modern and perfected diving dress. It was invented toward the end of the eighteenth century by C. H. Klingerts, of Breslau in Prussia, and it is related that a "huntsman" of the name of Joachim descended into a deep and rapid part of the River Oder clad in this dress on June 24, 1797, where he sawed and cut up logs of wood and showed how things could be attached to tackles below water and then hauled to the surface.

The armored portion of the dress consisted of a peculiarly-shaped helmet and a species of body cuirass. The former was constructed of copper and strengthened by iron bands on the inner surface; the latter was made of tin plate similarly strengthened.

The flexible part of the dress was made of waterproofed leather, and the tubes for the supply of air were also leather sewn around coiled brass wire. Each air pipe was fitted with a cylindrical receptacle for the moisture arising from the condensation of the breath, which are shown at the back of the figure in the accompanying sketch. Weights were suspended at the diver's waist in order to preserve his equilibrium when under water.

This constituted the ordinary diving dress as invented by Klingerts; but in order to make sure of a copious air supply when working at exceptional depths, the inventor contrived a special apparatus for use in combination with his diving dress, which is shown in the second drawing. This consisted of a reservoir of considerable size, made of stout metal. It was in the form of a cylinder with conical ends, and had a bracket or platform at one side of it on which the diver stood and on which also was placed a lantern for the illumination of his work on the sea floor. The whole affair, complete with the diver in position, would just float, its weight being about equal to the volume of water it displaced. It was ballasted in the lower part to keep it in a vertical position. When the diver wished to descend, he hove round on the winch handle beside him, which by means of a worm pinion revolved the wheel in the center of the machine, which in its turn pulled up a piston which moved in a cylindrical opening at the base of the apparatus, and so decreased the volume of air in the interior and caused the machine to descend. A reversal of this process was necessary when the diver wished to return to the surface. This peculiarly-shaped reservoir contained air enough to keep the diver supplied for the space of two hours. When it came above water, a lid or cover at the top was removed, the vitiated and exhausted air was pumped out by means of bellows and fresh air allowed to replace it, the cover was fastened down, and the machine was once more ready to dive.

It was an ingenious piece of mechanism, but there does not appear to be any record of its use. It is interesting to note, by the way, that the principle of rising and sinking by enlarging and reducing the bulk of air in the machine was one that had been suggested as long ago as the reign of Elizabeth, when an ex-naval gunner, William Bourne by name, proposed it for a submarine boat that he designed, and it was tried not many years back in the Campbell-Ash submarine boat, one of the many attempts made toward the end of the last century to solve the problem of submarine navigation.



HOW A CANE WAS MADE OUT OF COPIES OF THE SCIENTIFIC AMERICAN.

HOW TO MAKE A PAPER CANE.

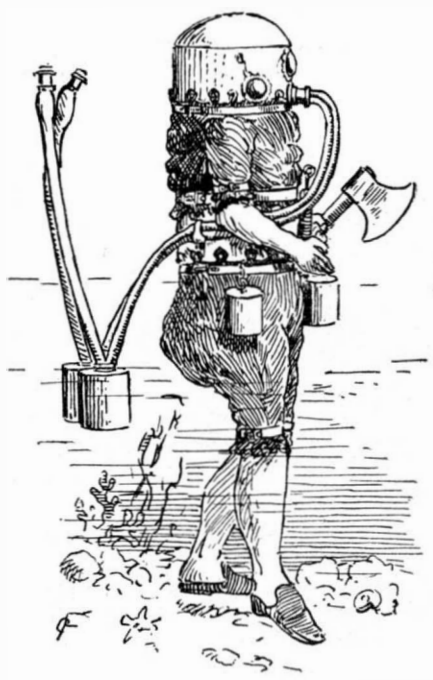
A convict confined in the Utah State prison has sent to the Editor a handsome paper cane, which, he states, was made from old copies of the SCIENTIFIC AMERICAN. The tools by which this cane was made are so few and the method employed is so simple that a boy with a little patience can produce similar canes out of old papers.

The core of the cane is a steel rod of octagonal cross section, ¼ of an inch to 5-16 of an inch in diameter, and about 3 feet in length. One end of the rod is threaded to receive a nut; the other end is provided with a ferrule of iron or steel. The iron rod thus constituted is shown in Fig. 1.

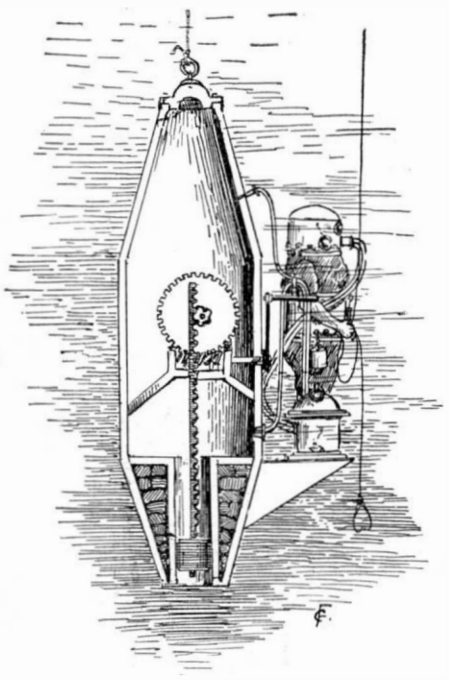
The paper to be used is cut into pieces about one inch square. By means of a hollow punch each piece of paper is pierced with a hole, the diameter of which corresponds with the diameter of the steel rod. These papers are slipped over the rod, very much as bills are held on a file, the first piece of paper resting against the top of the ferrule, which is about ⅜ of an inch in diameter at the top. Fig. 5 shows the rod with the pieces of paper slipped upon it. When five or six inches of paper, equivalent to about 1,500 or 1,800 pieces, are held by the rod, the nut is used to compress them into a solid, uniform mass. Since the rod is screw-threaded but 3 or 4 inches from its end, and the nut is far removed from the pieces of paper, discarded cotton spools are slipped over the rod, as shown in Fig. 6, in order to enable the nut to compress the paper. As the nut is turned, the pressure is transmitted through the spools to the paper. The nut can be turned either by means of a wrench or by means of a horn handle, with which the cane is to be provided after it is finished. This handle as shown in Fig. 4, is made of solid horn, recessed at one end to receive the rod. The opening is squared to fit over the nut.

The square pieces of paper are rounded off by means of a knife and rasp to the desired diameter. The cane is next sandpapered and then polished with emery cloth. A coat of oil is now applied, which when dry is polished with pumice stone. The polish thus attained is heightened with a little raw oil; and the cane is finished.

In the SCIENTIFIC AMERICAN SUPPLEMENT No. 353 will be found another method of making paper canes, the principle of which is substantially the same as that employed in making the cane illustrated.



KLINGERTS' DIVING DRESS (1797).



KLINGERTS' DIVING MACHINE FOR USE AT GREAT DEPTHS.

Cost of Electric Traction in Europe.

In a discussion on the Valtellina electric railway before the Elektrotechnische Verein in Vienna, Mr. Ross pointed out that the data furnished enabled one to make a trustworthy estimate of the cost of running railway lines by electricity generated by steam. The Valtellina line is worked on the three-phase system, and the energy supplied from the station, including losses of every kind, has amounted to 50 watts per gross ton-kilometer.

The southern railway system of Austria is of a very similar character to the Valtellina line, and during the year 1900 the gross tons-kilometers amounted to 4,468,932,400, and the number of locomotive kilometers was 18,576,000. Assuming the electric locomotives to weigh 50 tons each, the gross movement on this line if electrically worked would be 5,955,012,400 tons-kilometers, which at 50 watts in the station per ton-kilometer would require 269,886,620 kilowatt-hours. At the outside a kilowatt-hour, including all losses, would be supplied at a steam-driven station for 1.2 kilogrammes (2.64 pounds) of coal, corresponding to a yearly consumption of 324,000 tons. Actually, the steam locomotives take 391,960 tons of coal per annum, so that with electric driving there would be a saving of 20 per cent in the annual fuel consumption.

As our readers know, the Valtellina line is worked on the three-phase system, the current being supplied to the motors at 3,000 volts. Both electric locomotives and electric motor-cars are run over the line, the passenger service being worked by the latter. These cars have four motors arranged for working in cascade. The main motors, working alone, drive the car at a speed of about 40 miles per hour; the normal speed with the motors in cascade being half this. The normal tractive effort at 40 miles per hour is 1.22 tons, but the maximum goes up to 3.74 tons, and with the motors in cascade a maximum tractive effort of 5.4 tons is obtainable. This cascade coupling of the motors is used in starting the trains, and also in working up a long incline at Chiavenna, where there are 3.1 miles of line with a gradient of 1 in 50. The locomotives are not arranged for working in cascade; they have four motors, and are designed to run at a normal speed of 18 to 19 miles per hour, which is maintained constant up hill and down. The tractive effort at this speed is 5.2 tons, which at starting runs up to 9.6 tons. These figures are based on calculation, but actually it is found that the tractive effort is really much greater.

OLIVER J. D. HUGHES.

Among the workshop devices of recent origin, is a little attachment which makes an excellent pipe-wrench out of an ordinary monkey wrench. It is a little block of hard steel with toothed sides which is designed to be placed against one or the other of the jaws of the monkey wrench, being held in place by means of a small spring. It can be used in any position which is required of an ordinary pipe-wrench, side work, or in cramped quarters. If it is desired to pull the wrench toward the operator the attachment is placed against the upper jaw, but otherwise it is placed against the lower jaw. It is said to take a firm hold on the pipe and to be very serviceable.

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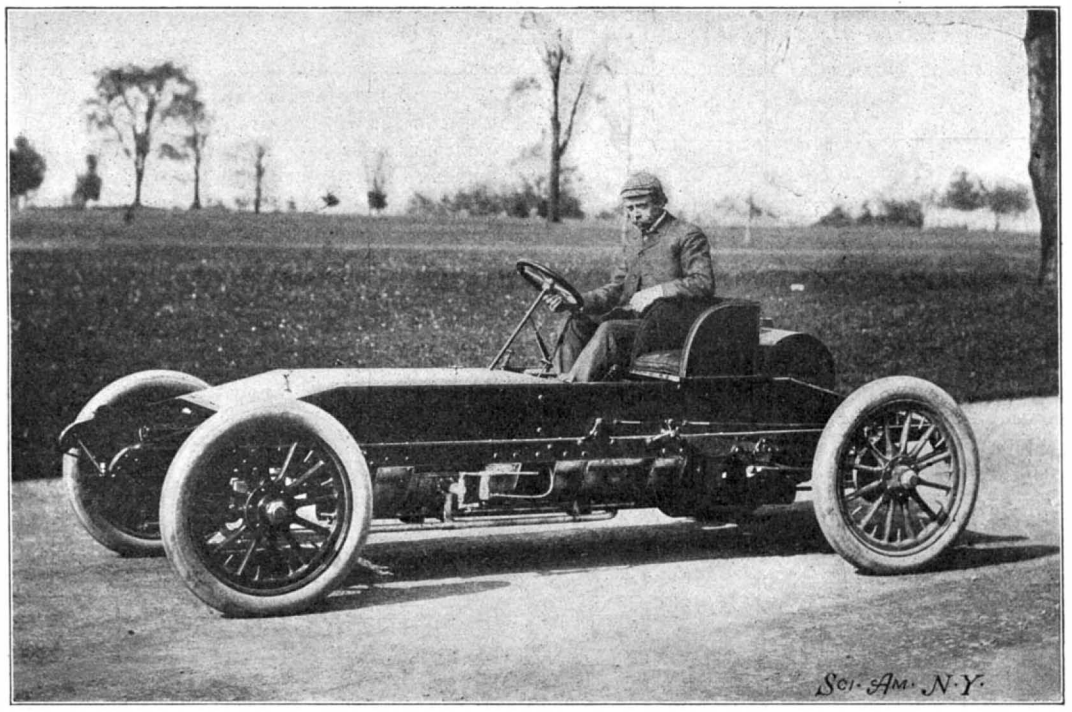
AMERICAN CARS TO COMPETE IN THE GORDON-BENNETT CUP RACE

Our illustrations give a good idea of the appearance of the Winton and Peerless racers that went to Ireland to compete in the Gordon-Bennett Cup Race on July 2.

In "Bullet No. 2," the long, low, high-powered car brakes on the hub of each rear wheel, one an expanding ring within the brake drum, and the other a brake band on the outside. The two brakes are applied by separate levers.

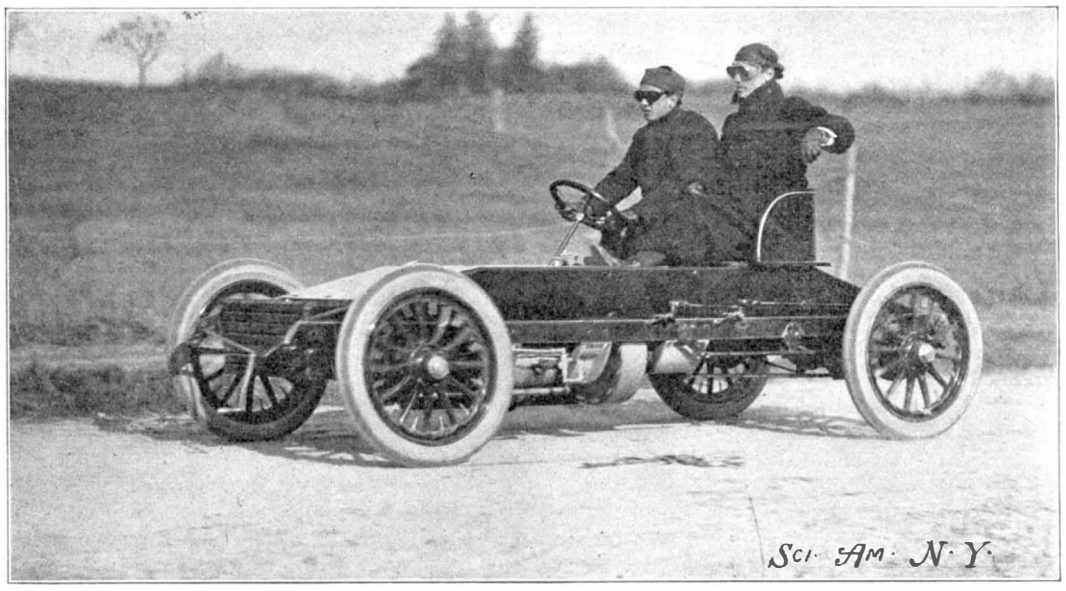
A single carbureter supplies gas for all the eight cylinders; but a separate centrifugal water-circulating pump is used for each group of four cylinders. The



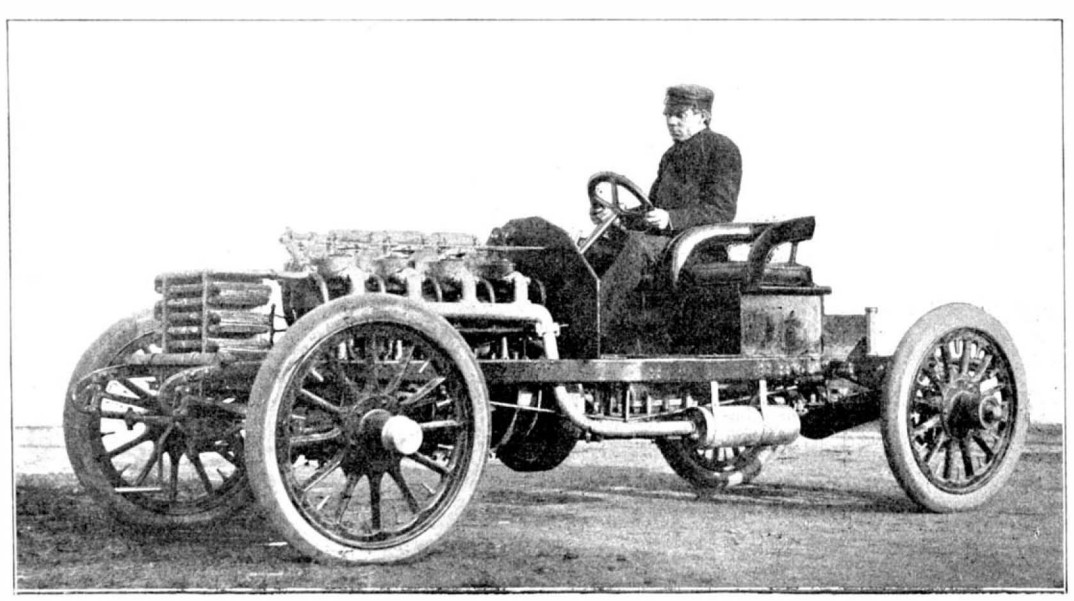
ALEXANDER WINTON ON HIS EIGHT-CYLINDER RACER. WEIGHT 2,150 POUNDS.

in which Mr. Winton is seen seated, were placed America's chief hopes of lifting the cup for this country. The machine is the outcome of all Mr. Winton's racing experience, and is without doubt a very smooth-running, speedy car. Planned on the general lines of the first "Bullet," which made a name for itself breaking records and which we illustrated in our issue of January 17, the chief feature of the new machine that strikes one, upon examining it, is the great abundance of power beneath its flat, sloping body. Mr. Winton has followed up the experiments of Charron, Giradot, and Voigt with an eight-cylinder motor quite closely, it would seem, for he has equipped his new racer with a similar engine having eight 5 x 6-inch cylinders. The eight cylinders are arranged in two groups of four each. They are horizontal, set transversely of the body, with their heads on the opposite side of the car to that shown, the crank shaft being on the side shown in the picture. A cone clutch in the flywheel connects the crank shaft directly to the differential on the back axle through a longitudinal driving shaft. A speed reduction of 1¼ to 1 is used, and at 700 R. P. M. of the motor, the car will travel at the rate of 64 miles an hour. As the motor is said to be capable of turning up 1,000 R. P. M., the car has a maximum speed of over 90 miles an hour, while it can also be slowed down to 9 miles an hour by throttling the motor. Its weight complete, with tanks empty, is 2,150 pounds. The capacity of the gasoline tank is 22 gallons, and that of the water tank, 12½. It has a wheel base of 9½ feet, and a gage of 4 feet, 8 inches. It is fitted with no slow speed or reverse, but simply with the clutch and direct drive to the rear axle. Wheel steering is employed, the hand wheel shaft being connected to a short shaft carrying a bell crank by means of a worm gear and sector. A tubular rod runs from the universal joint on the bell crank to the steering arm beside the front wheel. There are two pumps make half as many R. P. M. as the motor, and keep up a good circulation through the radiating coils in front.

The smaller Winton racer is built on the same general lines as the one just described. It has half the power of its big brother—four cylinders instead of eight—and weighs over two-thirds as much (1,450 pounds with tanks empty). The performance of these two machines should demonstrate, therefore, whether twice the power will more than compensate for less than one-third extra weight. The smaller machine was driven by Mr. Percy Owen.



PERCY OWEN ON HIS FOUR-CYLINDER WINTON CAR. WEIGHT 1,450 POUNDS.



LOUIS P. MOOERS ON HIS 80 HORSE POWER "PEERLESS" RACER. WEIGHT 2,200 POUNDS.

The "Peerless" racing car is built on the general lines of the regular "Peerless" machines which we have illustrated heretofore. The motor has four upright cylinders of 6 inches bore by 6 inches stroke. The cylinders are made of steel tubing, and are screwed into heads which are cast with a water jacket. The water jacket extends nearly half way down on the outside of the cylinder. Mechanically-operated inlet valves and both jump spark and contact igniters are two of the features of this motor. A magneto is used to supply current for the contact igniter system. The exhaust side of the motor is shown in the photograph, and the exhaust pipes from the four cylinders are plainly to be seen, as they bend down and join the main pipe that runs back to the muffler. Unlike the other cars, the "Peerless" racer is fitted with a sliding transmission gear of the usual type, giving a direct drive on the high speed. The machine has a wheel base of 9 feet, 2 inches, and measures 13 feet, 4 inches over all. It weighs slightly less than the limit of 2,200 pounds, and its motor is said to be capable of developing 80 horse power. It was driven in the race by its constructor, Mr. Louis P. Mooers.

The Second Ziegler Expedition Sails for the Arctic.

Commanded by Anthony Fiala, the Ziegler North Pole expedition started on the steamer "America" from Trondhjem on June 23. Fiala hopes to find a good harbor in Franz Josef Land, where the expedition intends to pass the winter.

Santos-Dumont's Latest Airship Trip.

On June 23 Santos-Dumont made a most remarkable trip in his new airship No. 9, the smallest of the series which he has so far built. Starting at 4:30 from Longchamps, he proceeded in the direction of the Place de l'Etoile. He executed a number of skillful maneuvers and encircled the Arc de Triomphe. Then, turning down the Champs Elysées he alighted at his house, where he breakfasted. Bystanders and mechanics held down the airship in the meantime. After breakfasting the aeronaut entered his airship and returned to Longchamps. The entire trip seems to have been accomplished with as much ease as if the Brazilian had ridden in his carriage.

A New Track for the Berlin-Zossen Road.

It will be remembered that the first tests on the Berlin-Zossen road with high-speed electric locomotives and cars had to be abandoned because it was found that the track was too light for speeds above 99.4 miles an hour. The amount of $72,000 has now been appropriated by the Reichstag for a new track. In place of the present 67-pound rails, 82-pound rails will be used, laid on new fir ties, with hardwood plates 18 to the rail, ballasted with fine broken basalt.

News was received in San Francisco by wire from Midway Island on June 23 for the first time. A cablegram stated that the steamer "Anglia" had left the island for Honolulu, presumably with the last section of the Pacific cable which is intended to connect San Francisco with Manila. The news was sent to Manila over a section just laid, and then by one of the old cable routes. Unless unforeseen accidents occur, the line will shortly be in operation directly from San Francisco to the Philippines.

Marconi wireless telegraphic apparatus has been installed on the steamship "Deutschland." Four other ships of the Hamburg-American Line are also to be equipped with the apparatus.

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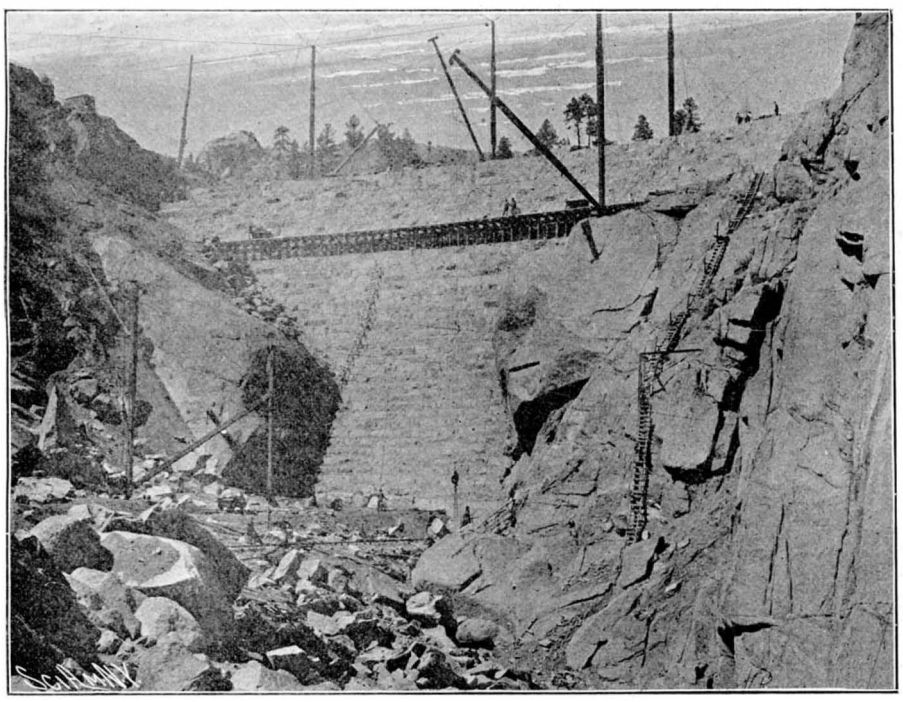
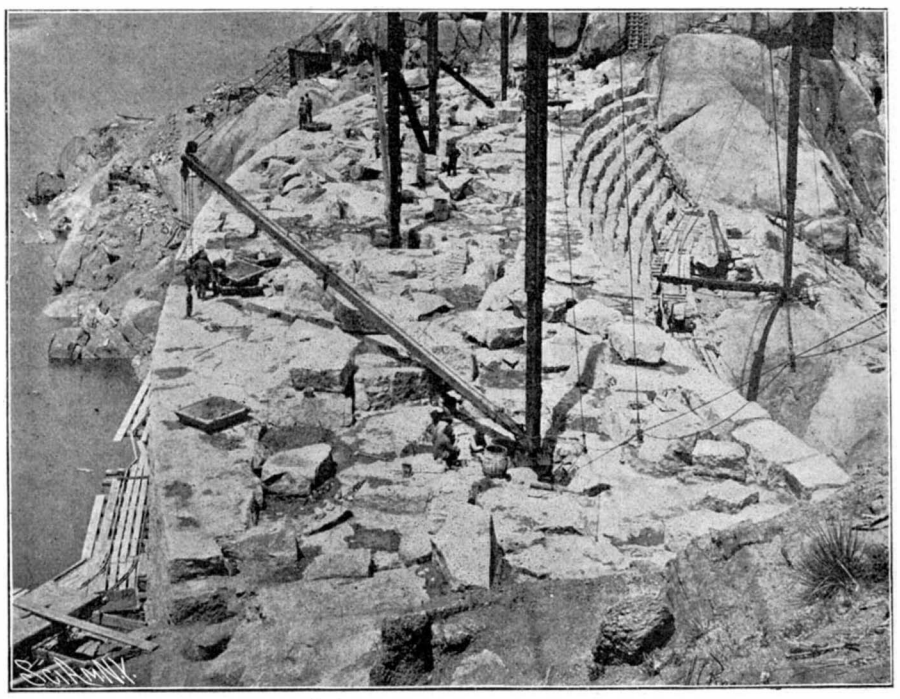
THE GREAT GOOSE CREEK DAM FOR THE DENVER WATER SUPPLY.

The water famine which threatened the city of Denver in the summer of 1902 served incidentally to confirm the wisdom which had prompted the construction of a great storage reservoir which is now approaching completion in the Platte cañon at a point where the South Platte River and Lost Fork Creek converge. Measured on an air line from Denver, the distance to the new dam is about 50 miles; but measured by the traveled route which lies up the Platte cañon by way of the Colorado and Southern Railroad to Buffalo Station, and from there by a stage ride of 20 miles, the distance to the dam is about 61 miles. From the dam the water will be carried down the South Platte to the mouth of the Platte cañon, where it will be filtered and then piped to the local storage reservoirs surrounding the city of Denver. There are several features which cause this dam to rank as one of the most notable in the world, chief among which is its great height from toe to crest of 231 feet; moreover, when it is completely filled it will impound about 30,000,000,000 gallons of water, which is about the same amount as will be impounded by the new Croton dam of the New York water supply. The natural configuration and geological character of the site of the dam are ideal for a structure of this nature, for at the bed of the river the solid gray granite walls of the cañon approach within 12 feet of each other, and they rise at an average angle of 45 degrees on both sides to a height of several hundreds of feet. In constructing a dam at this spot it was only necessary to raise it to a height of 66 feet to cause the water to back up for a distance of 3½ miles and provide a lake varying in width from half a mile to a mile; and by carrying it to its full height of 231 feet, the water will be backed up to a distance of about 7 miles, and will provide a supply of water sufficient to last the city of Denver for three years, even if the reservoir should not be replenished by rainfall or by melting snow.

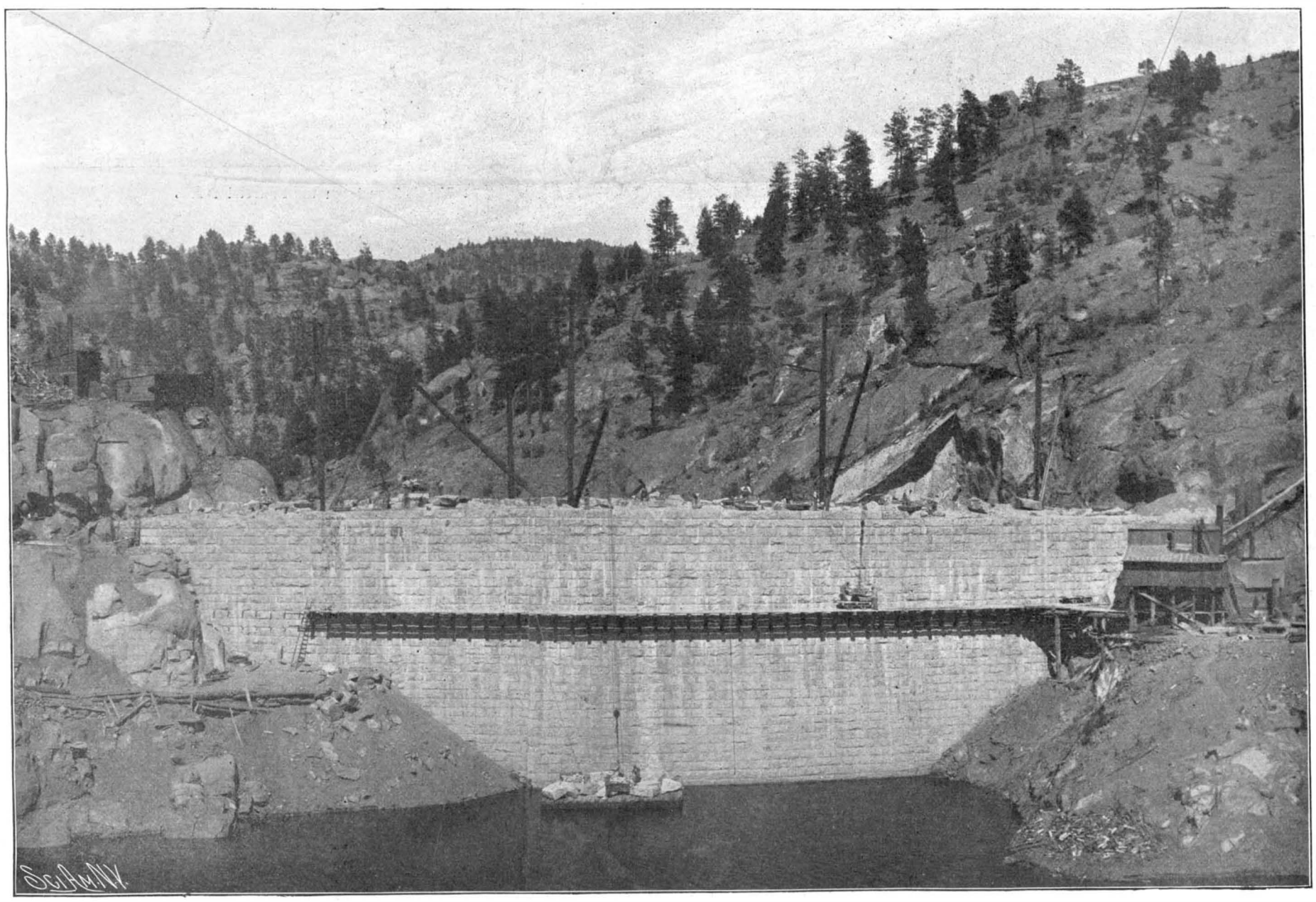
The upstream side of the dam will be approximately perpendicular. At its greatest depth, measured through the bottom of the foundation, the masonry is 178 feet in thickness, and it will taper on the downstream side from 178 feet to a width of 18 feet at the crest of the dam. The enormous pressure of the water due to its great head will be resisted both by the mass of the masonry and by its arched form, the upstream face of the dam being built with a curve of 400 feet radius. The curved dam system of construction is frequently used in western works of this character, where the narrowness of the cañon admits of an arch of moderate span being thrown across it, and where the splendid character of the rock on the hillsides affords a perfectly secure abutment, amply able to take the heavy thrust which is set up when the dam is filled to its full height. In a structure of this character the stresses are somewhat complicated and not absolutely determinate. The bulk of the stress takes the form of a thrust against the abutments, the inertia of the mass against overturning on the toe acting as a reserve of stability, which would come into play should there be any give of the lateral abutments. Theoretically, with absolutely unyielding abutments, this great arch would require no such thickness as 178 feet at the base; but the provision of such a mass of masonry indicates



Dam From Downstream Side, Built to 130-foot Level.



Top of Dam During Construction, Showing Arched Form.



View of Dam From the Upstream Side.

THE GREAT GOOSE CREEK DAM FOR THE DENVER WATER SUPPLY.

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conservative judgment and a commendable determination on the part of the engineers to insert in the structure every element of strength that can be given to it.

The facing stones on both the upstream and downstream sides of the dam weigh from 6 to 8 tons each, and are quarried just to the south of the dam. The downstream face is built in steps of cut stone, as shown in our illustrations, while the body of the dam is filled in with granite blocks varying in weight up to a maximum of about 8 tons, the whole mass of masonry being laid in the best cement. The length of the dam from one side of the cañon to the other measured along the curved face is about 12 feet at the base and 675 feet at the crest. At elevations of 10, 60, and 110 feet above the riverbed, tunnels have been cut into the granite mountain, a little to the south of the dam, which pass entirely around the structure, the two upper tunnels converging to meet the lower one and emerging in the cañon on the lower side of the dam. These tunnels, which are controlled by 42-inch hydraulic valves, will enable the water to be drawn off from either of the three levels as may be desired. They will also be used as auxiliaries to the spillway in times of heavy flood. The spillway, which lies a few hundred yards to the south of the dam, is formed by making use of a natural depression in the rock, which has been blasted down for a length of 250 feet to the desired level. It is estimated that with five feet of water passing over this spillway, and with one 42-inch valve opened under a head of 100 feet, it will be possible to get rid of surplus water at the rate of 17,000 cubic feet per second.

Word from the Mount McKinley Expedition.

Word has been received from Dr. Cook's expedition that the ascent of Mount McKinley is about to be begun.

The men have fifteen pack horses with them and 1,250 pounds of supplies, which are calculated to last them all summer.

The party will study the region traversed and will try to measure the exact height of Mount McKinley. They have other commissions, one from the Arctic Club of this city to discover whether the mountain is of volcanic origin.

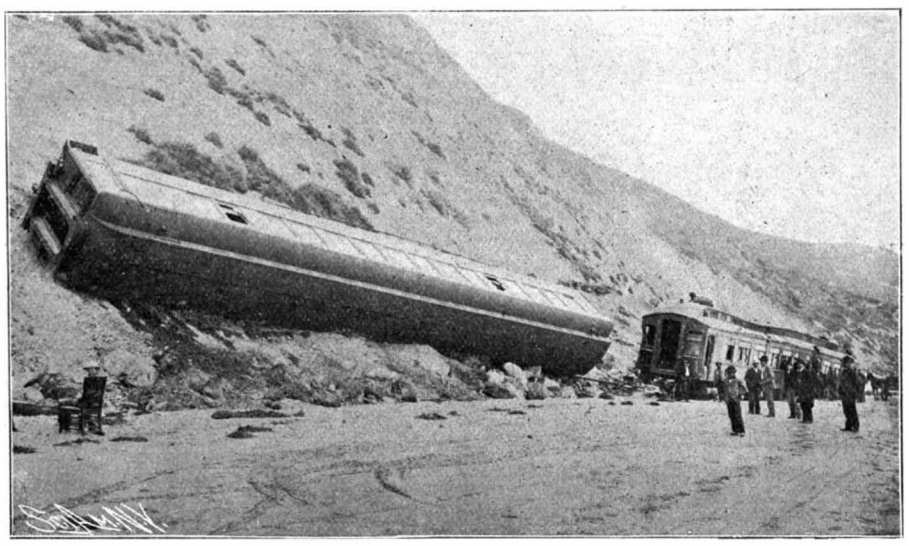
The plans for the tunnel by which trains will enter the Union Station to be built in Washington provide for a branch tunnel to connect the main subway with the basement of the proposed office building for the use of members of the House of Representatives.

PULLMAN CARS IN A RAILROAD WRECK.

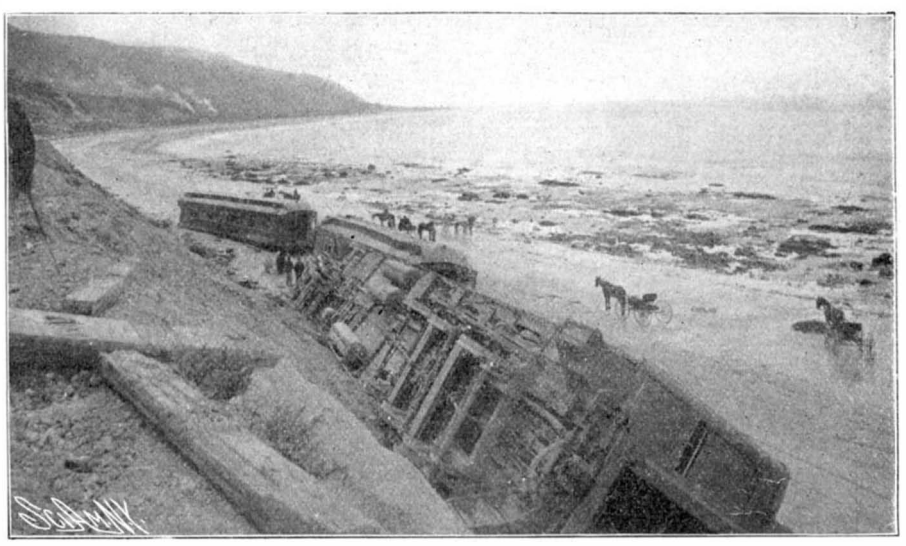
The remarkable strength of the Pullman car, when it is subjected to the twisting and crushing effects of a derailment or a collision, is so well known as to need no further demonstration after its many decades of hard and useful service; but the truly remarkable manner in which the three cars shown in the accompanying wreck went through the ordeal of being rolled down a 35-foot embankment calls surely for special mention—particularly when it is borne in mind that of the occupants of these cars, not one was killed, and only one or two were seriously injured.

The wreck occurred at Punta Gorda, not far from Santa Barbara, Cal., on the line of the Southern Pacific Railway. At the place where the derailment occurred, the track, which is level and on a three-degree curve, runs around the base of the cliffs on an embankment which is 35 feet above the sandy beach of the Pacific Ocean. The train, which was made up of seven cars, was running at a speed of about 35 miles an hour, when the driving wheels of the engine left the rails, and the rear cars after running along for some 130 feet, were wrecked in the manner shown in our illustrations. Strange to say, the pony truck of the engine, the tender, and the three leading cars of the train, kept the rails; the four rear cars, however, consisting of a chair car, a dining car, and a parlor car, followed by a chair car, jumped the track. The chair car and the dining car rolled down the embankment and finally landed, right side up, on the beach, but minus their trucks. The parlor car turned almost completely over, and came to rest in the position shown in our engraving, lying upon its side on the slope of the embankment. The last car of the train came to rest diagonally across the track, the forward end obstructing the traffic, and the after end being slewed around until it overhung the embankment. The accompanying illustrations speak for themselves and require no detailed explanation; but attention is drawn to the fact that although the cars were moving at the rate of between 30 and 40 miles an hour, and that in rolling over down the bank, the roofs had to endure the tremendous wrench and impact of the 50-ton mass of the car, they proved equal to the task. The interior and exterior views of the chair car show that the roof, as a whole, remained intact, being crushed in only at one point, and there probably by some projecting bowlder. The injuries to the passengers were such as would naturally result from their being pitched from floor to ceiling, and from ceiling to floor, as the cars rolled over; and to the wonderful strength of the framing and roof is to be attributed the escape of the passengers with nothing worse than some bad cuts and bruises. The cars were brought back to the track by building several hundred yards of temporary track from the beach to the level of the main line.

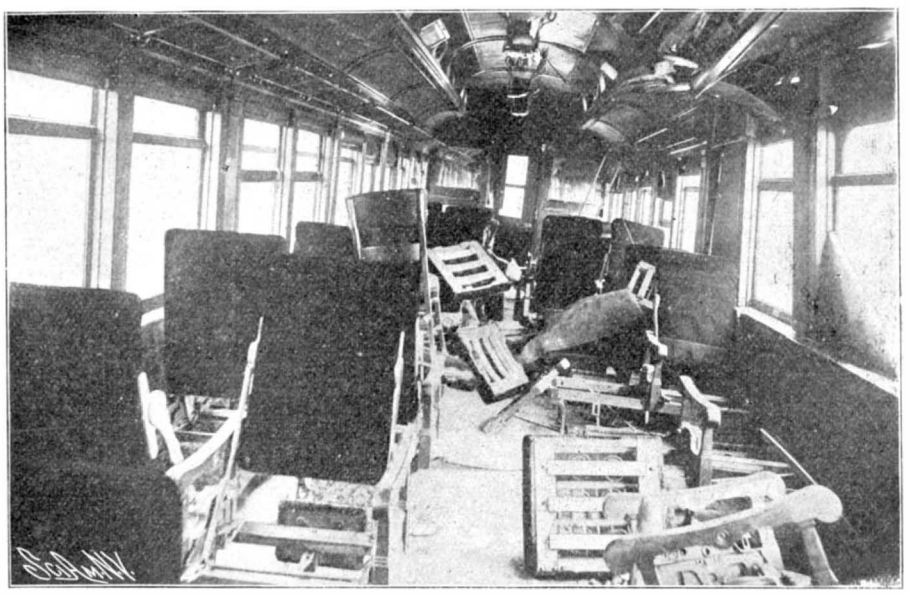
The great strength of Pullman cars, as here demonstrated, is due to the excellence of the material of which they are built and the thoroughly scientific manner in which this material is disposed. To all intents and purposes a Pullman car is a trussed bridge, the two trucks being the piers or abutments on which it rests. Below the window sills within the outside sheathing is a stout steel and timber truss which extends for the full length of the car. The floor is also admirably adapted to withstand the shock of a collision, being framed of heavy longitudinal sills with steel plating sandwiched in between them. The latest cars have also steel framing at the corner posts and in the sides and roof. We are indebted for our illustrations and particulars to Mr. E. W. Hadley, of Santa Barbara.



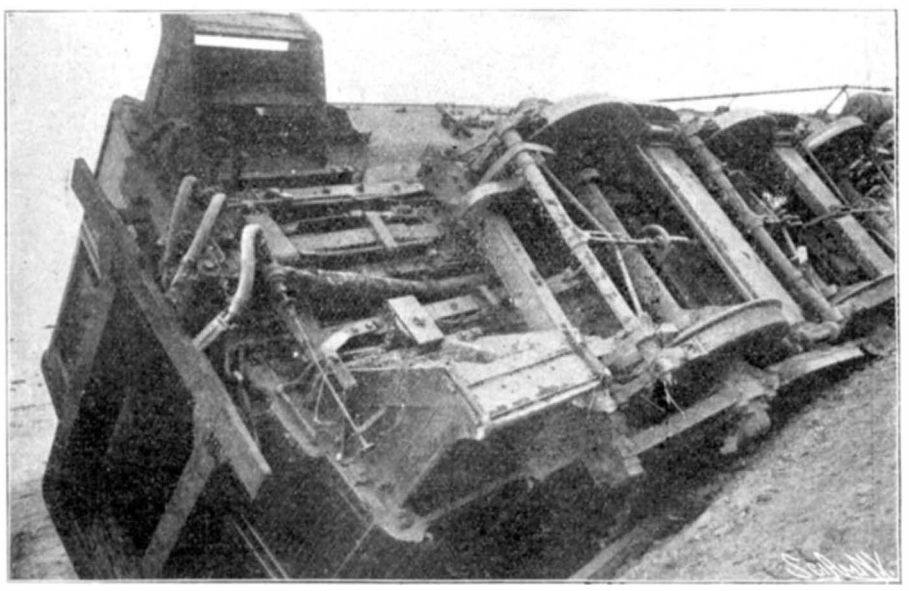
View of the Wreck Taken From the Beach.



The Wreck Seen From the Railroad Track.



Interior of Chair Car After the Wreck.



The Parlor Car, Bottom Side Up.

PULLMAN CARS IN A RAILROAD WRECK.

The Death of Dr. Common.

The death has occurred in England of Dr. Common, the inventor of telescopic gunsights and the constructor of large telescopes. His telescopic sight is now being fitted to all guns in both the British military and naval services, and was utilized with conspicuous success in the South African war. In this sighting apparatus a small telescope is fitted to the barrel of the rifle or gun, and the marksman brings the object at which he is aiming, exactly behind a tiny point made by the bisecting of two capilliform straight lines, crossing at right angles upon the lens. When this position is obtained perfect marksmanship is assured. Dr. Common's greatest work, however, has been the manufacture of huge telescopes; and prior to the construction of the Lick and Paris reflecting telescopes, he had built the largest instrument of this character in the world. He devoted a great amount of his time to the discovery and perfection of a method for grinding reflecting glasses from three to five feet in diameter, and succeeded in making a five-foot reflector, with which he secured a photograph of the nebula of Orion. For this work he was awarded the gold medal of the British Astronomical Society.

Pelican Island in Indian River, of the coast of Florida, has been acquired by the Department of Agriculture as a government reservation. The step was taken to prevent the entire extinction of the brown pelicans which breed there.

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SELLING PATENTS FOR CASH MADE EASY.

A new and very ingenious method of entrapping the unwary inventor has recently been inaugurated, and under a guise so complete and alluring as to be worthy of more than passing mention. It is not every inventor who immediately upon the issuance of his United States patent receives from what appears to be a reliable corporation with an immense capital, a *cash* offer of hundreds or perhaps thousands of dollars for his patent. If you are an inventor, dear reader, and have recently obtained a patent, you may be the fortunate one—but beware!

The scheme of procedure is so tortuous, and the methods employed so well formulated, that the suspicions of the most wary are likely to be put to sleep. Picture to yourself a manufacturing company duly incorporated with a capital of $2,000,000, and with a formidable board of directors. The company has been formed, so it states in its prospectus, with the purpose of purchasing, manufacturing, or controlling patented devices of approved commercial value. Surely this is a laudable and praiseworthy enterprise.

When the victim, among the many inventors whose names appear weekly in the Patent Office Gazette, has been selected, he receives a letter from one of the officers of the company, saying that the victim's patent has been placed before the executive board of the manufacturing company, and in view of the merits of the invention that the company has decided to make an offer for the patent; that it will pay so many thousands of dollars in cash and a like amount in seven per cent cumulative preferred stock of the company. Preliminary to the closing of the contract, however, there will be found the following carefully-worded requirement, which is a condition precedent to the conclusion of the purchase. It is to the effect that few of the patents that the company has "purchased" (?), or has now under consideration, have been worked sufficiently to have been tested in the courts as to validity or infringement, and that, therefore, any patent purchased by the company must undergo a thorough examination by the company's expert before such sale can be consummated. The statement then follows that such examination has been made by the patent counsel of the company, who has gone over the specifications very carefully and pronounced them O. K. This certainly is most satisfactory to the patentee, and he almost feels the hard crisp gold in the hollow of his hand, but this is not all. It is a rule of the company that before such sale can be consummated, an expert opinion shall also be "rendered from the classification at Washington," whatever that may mean, "by the patent attorney and mechanical expert of this company." The letter also states that all the patents so far considered by the company have been passed upon favorably by the company's counsel, and the deals closed. It also states that the company will not consider any counter proposition and any change from the above conditions, from which it may be inferred that they would not listen for a moment to the inventor, even though he would part with his patent for one-half the price offered. In order to clinch the argument and close the contract, it is remarked incidentally that during the past ten days the stock of the company has risen from $50 to $100 per share.

The bait is a very attractive one, and is thoroughly sugar-coated. Swallowing is made easy. The inventor, who is often not a man of affairs, takes home with him the letter he has received, and with pride lays it before his wife, who, perhaps, has not always been in entire sympathy with his taste and talents for invention. Here he has received a *bona fide* cash offer from a rich corporation, and at the same time becomes a stockholder in the enterprise, which pays "at least seven per cent cumulative dividends on the preferred stock, and will undoubtedly pay twice that on its common stock." He writes to the counsel of the company, but is somewhat staggered when he is informed what the fee will be for conducting the examination "in the classification at Washington." He is called upon to go deep down into his pocket, but why should he hesitate?—the prize is such a rich one. Beware! my friend. Beware! The fee asked, perhaps, is not exorbitant for the service which is supposed to be rendered, but is it made in good faith? Does the company really desire to become the owner of your patent? Is it sincere in its professions, or is it striving to wheedle you out of a "lawyer's" fee and then turn you down? If it is sincere, why does it offer you an enormous price for a patent which you would gladly sell for one-half or one-tenth the price? The proposition is unbusinesslike, and bears an unsavory odor. You are asked to become a stockholder in a company which makes a claim to paying handsome dividends on its stock, but would you care to embark on an enterprise conducted on such loose business principles, even assuming the intents of the promoters to be honest?

Upon what is the company now paying its dividends? The prospectus states that "the company proposes to erect a plant of sufficient magnitude to manufacture the several lines which can be economically produced." Beautiful words! Delightful vagueness! There are two features of the enterprise concerning which there is positively no vagueness. If you join the enterprise and sell your patent, you must pay the counsel of the company his good round fee. If you are not fortunate enough to be blessed with an inventive faculty, and do not have at the moment a patent to sell, be of good cheer, nevertheless, you will be allowed an opportunity of purchasing some of the stock of the company in the open market, and you had better get in quickly, for it has gone up one hundred per cent in ten days. *"O tempora! O mores!"*

Brief Notes Concerning Patents.

The wear and tear on the telegraph operator's nerves are said to be particularly severe on account of the great number of signals which he must send in the course of a few hours' work and also because of the great rapidity with which he must work. As is well known, the various signals are made by a combination of the dot and dash, the letter "p," for instance, requiring five dots and the letter "b" a dash and three dots. With the telegraph key now in use, in sending the five dots indicating a "p" the operator must depress and release his key five times and thus it is estimated that in the course of sending messages in the ordinary pursuit of his work, the operator is compelled to make one hundred and eighty thousand depressions and the same number of relaxations in the course of eight hours' work, during which time he would send about 15,000 words. It will readily be seen that the work is exceedingly trying on the nerves. Much of this labor has been avoided by the use of a new invention, recently patented by Horace G. Martin. It is about the size of the Morse relay and is known as the "autoplex." It has one lever which works from the side, there being a contact point at each side. As long as the lever is held at one side, the automatic mechanism is set in motion and the dots are sent out one after the other. Upon shifting the lever to the other side, the dash mechanism is set in motion and the dashes will be repeated indefinitely if desired. With this device a word which requires thirty-two movements is sent with twelve and it is estimated that the operator's work is reduced by two-thirds.

A new device by which water can be applied to the roots of plants constantly and without danger of flooding the earth in which the plant is growing, has been designed by a German inventor and recently introduced into this country. It consists of a glass bulb resembling in shape an incandescent electric lamp but somewhat larger. This has a long neck at the narrow end and the extremity of this is supplied with a vent through which the bulb is filled. When the bulb is inverted the water is held in place by suction, but the pointed end being thrust into the ground, the water is drawn therefrom slowly but in sufficient quantities to supply the plant.

A great deal of overhead cable is now used in the transportation of materials about quarries, mines, and similar plants, and heretofore the method pursued of painting these metal cords with the preservative necessary to prevent the action of the moisture of the air has been an exceedingly tedious and dangerous task. A means of doing this work mechanically has been recently devised. The apparatus consists of a cylindrical tank with a slot through its entire length. When the tank is placed in position, it fits above and around the cable with the latter in the slot. The tank is then filled with the preservative and it is applied to the cable by means of a lining of packing which comes in contact with the wire cable as the apparatus is passed along the wire. There are grooved wheels at either end which support the weight of the tank and maintain it in its proper place on the wire and a pendant weight keeps it in an upright position.

As the result of offering a prize for the best device for the purpose, a type of apparatus has been adopted in the German army for the purification of water. The prize was won by a Berlin firm which now has the contract of building a number of outfits, and it is proposed to supply one of them to each army corps. With the aid of these it is hoped to be able to furnish the men with a good supply of wholesome water, although it may be necessary to draw the same from sources which may be more or less contaminated. The apparatus is in the shape of a portable engine and in operation it has a capacity of fifteen gallons an hour. In order to put it to the severest test that could be devised, the apparatus was tried on water which had been mixed to a high degree with typhoid and cholera germs, and in the water delivered there was no trace of the diseases.

During his fourth term in the penitentiary at Trenton, N. J., Charles Filer invented a machine for sewing the bottoms of trousers, which has heretofore been done by hand. This device, it is claimed, will do the work of twenty men and do it better. The attention of some capitalists in Trenton and other parts of New Jersey was called to the machine, and before Filer's release patents were secured in this and foreign countries for him. When the gates were opened to set him at liberty, he found himself a member of a powerful company with himself as the superintendent. Incidentally a young woman who had become interested in him has agreed to marry him and he has decided to live a new life.

In order to demonstrate beyond all doubt that the fender invented by him would do all that he claimed for it, Benjamin Lev, of Cleveland, Ohio, threw himself in front of a car equipped with one of the fenders while it was moving down a very decided grade at the rate of twelve miles an hour. The inventor had taken no precautions in the way of protecting his body with extra clothing or by giving notice to the motorman of what he was about to do, but he had several persons present to witness the unusual test. He had claimed that the apparatus would strike any one in the way of the car and pick him up without doing him the least injury and his experience vindicated his promise. The car was stopped as soon as possible and he was taken from the basket of the fender and found to have sustained no injury whatever. He had not a scratch as the result of the demonstration. The fender consists of a lattice-work of band iron and pivoted at an angle of about forty-five degrees in front of the car. At the lower end of the fender is a hollow rubber cylinder which strikes about the ankles of a person in the way of a car, and the force of the fall is taken up by the body falling on the inclined surface of the fender which immediately tips back with the weight thrown upon it and holds the person as if in a basket. A flexible screen also prevents the person struck from being injured by coming in contact with the front part of the car.

The third-rail system has been robbed of much of its danger by an innovation in construction which has been worked out by Louis E. Walkins, of Springfield, Mass. This consists of the third rail as it is ordinarily used, except that it is inverted and supended from brackets in such a way that there is no opposition offered to the passage of a sliding shoe projecting from the car truck and in contact with the lower part of the rail. The third rail is fastened to the brackets by means of a lock-joint insulated wedge, and the whole is covered in such a way that it is impossible for man or beast to come in contact with the charged rail without getting down on the ground and reaching up and under the covering. Besides the element of safety offered, another feature is that the rail is kept free from the accumulations of snow and ice which are a serious annoyance where the rail is exposed, as is the usual practice. The cost of an installation of this kind is said to be but little more than the present system now in use in New York.

In street railway practice, much trouble and delay are occasioned by the accumulations which gather in the grooves of switches, thus interfering with their operation. A recent improvement in this line is a self-cleaning switch. The point instead of traveling back and forth on a solid bed, rests on pieces of rail with a large chamber underneath which has a connection with the sewer, and by this means all dirt falls through at once and is carried away. This switch is the invention of P. J. Ramion, of Syracuse, N. Y., and has a number of other incidental features which may be availed of or discarded at the desire of the company. For instance, it is supplied with accommodations for a small heater by which the metal is kept at a temperature which will melt the snow as it falls, thus preventing another source of delay in winter weather. Another feature of the device is that it can be worked from the platform of the car by an ingenious arrangement. The essential feature however is the means of carrying off the dirt which usually collects in the groove and prevents the operation of the point.

As a means of facilitating the movement of its trains, particularly in its yards, the Chicago, Milwaukee & St. Paul Railway has installed a rather elaborate telephone plant, connecting the terminal headquarters with the flagmen's houses along the tracks. This will prevent congestion of the tracks in the yards and also do away with delays of city traffic at street crossings. In the future, all freight trains will be stopped in the suburbs or outside of the city until the main yard can be communicated with and it can be learned that there is a track in readiness for the train. The cause of blocked crossings has been caused mostly by allowing trains to enter the yard before there is room for them, and they are necessarily held up on some street crossing.

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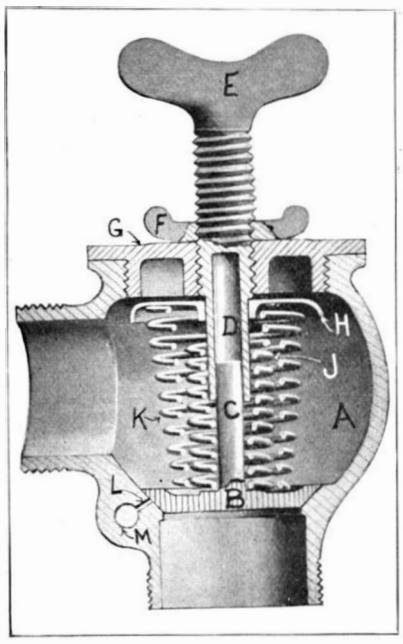
VAPORIZER FOR INTERNAL COMBUSTION ENGINES.

By an improved construction and arrangement of parts Mr. O. B. Perkins, of Gloucester, Mass., has provided a vaporizer in which the ratio of the air and fuel in the explosive mixture will remain the same, notwithstanding that the volume of the mixture may be varied considerably according to the adjustment of the vaporizer. The construction of the vaporizer can best be understood by reference to the accompanying illustration. A valve *B* works on a seat in the shell *A*, and is adapted to be engaged at every suction stroke of the engine to admit gasoline and air. The stem *C* of the valve slides freely in the hollow shank *D* of the adjusting screw *E*. This screw is threaded through the head *G* of the vaporizer, and is provided with a lock nut *F* to hold it firmly at any adjustment. At the top of the shank *D* is a plate *H*, and pressing against this and the valve is a spring *K*, while within this spring is a shorter one *J*, which does not normally engage the plate. The gasoline supply pipe is shown at *M*, the inlet port *L* being normally closed by the valve *B*. In the operation of the vaporizer, after the gasoline supply is adjusted, to run the engine full speed the screw *E* should be moved upward, placing the spring *K* under minimum tension, and thus the valve *B* will be lifted at every inception of the suction stroke, and the gasoline and air will be drawn into the cylinder throughout the whole of the stroke, thus attaining the maximum charge. This may be slightly decreased by increasing the tension of the spring *K* without, however, bringing the spring *J* into action; but to merely slow down or throttle the engine, the screw *E* and plate *H* should be moved down until the spring *J* is placed under tension. This increased pressure on the valve will prevent it from lifting until a material part of the suction stroke is traversed, and the result is that the cylinder will be charged only during part of the suction stroke. The quality of the combustible mixture is, however, unchanged.

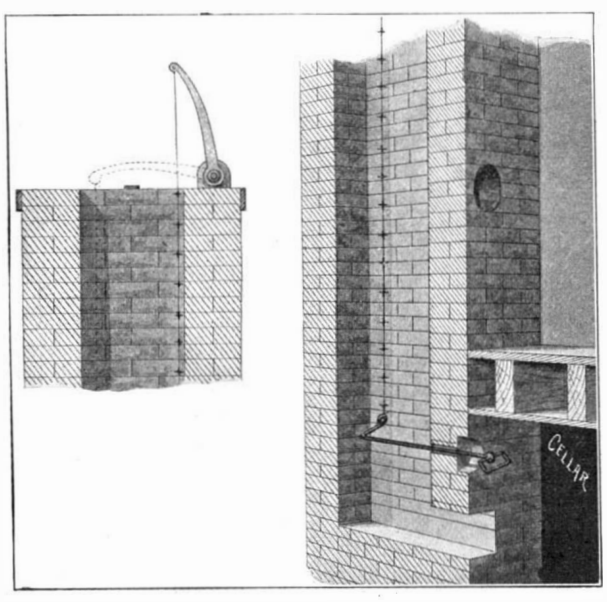


VAPORIZER FOR INTERNAL COMBUSTION ENGINES.

A SIMPLE CHIMNEY FLUE CLEANER.

A patent recently granted to Mr. J. A. Stine, of Manistee, Mich., covers the invention of a chimney flue cleaner of novel and very effective design. The cleaner is installed as a permanent fixture in the chimney and is ready for use at any time. The device is illustrated in the accompanying engraving, the small view at the left showing the top of the chimney. As will be observed, the chimney cleaner comprises a chain or wire rope hung from an arm at the top of the chimney and secured to a shaker at the bottom of the flue. At frequent intervals throughout its length, the chain is provided with disks of cast or malleable iron, which are adapted to scrape the soot off the chimney walls. The arm at the top of the flue is mounted in bearings projecting from a metal band which surrounds the top of the chimney and thus affords a firm support, at the same time preventing the bricks from working loose under action of the weather, or the operation of the cleaning device. The chain supporting arm is normally held in the position illustrated by coil springs on the journals.

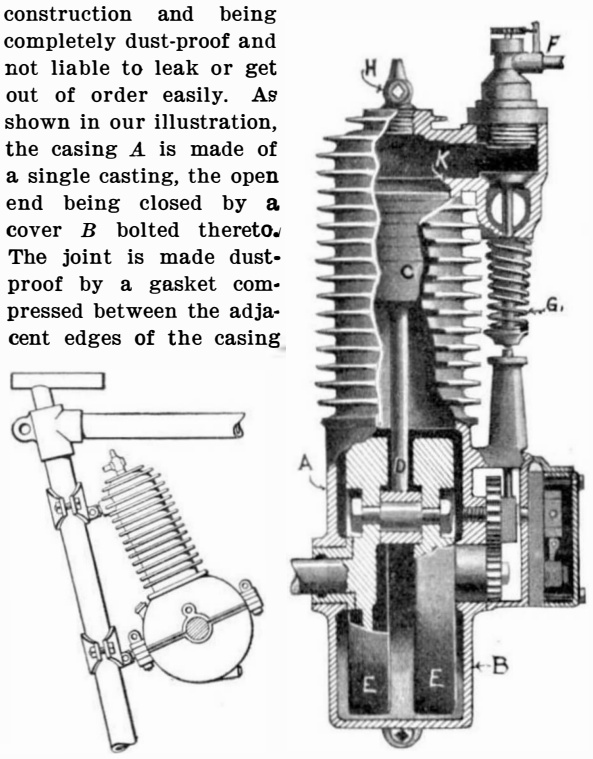
The cleaner can be very easily operated. The shaker rod at the bottom of the flue is turned, drawing down the chain and scrapers against one or the other side of the flue depending upon the direction of turning the shaker rod. When the chain is drawn down the arm above swings to the position shown in dotted line carrying the cleaner chain from one side to the other of the chimney, the lower end of the chain can be similarly moved by operating the shaker rod in and out of the flue. In this way every part of the chimney can be reached by the scraper disks. The disks are quite small, being less than an inch in diameter, so as to easily clean out the corners of the chimney. If objection is made to the appearance of the arm on the chimney top, this may be easily drawn down out of sight by turning the shaker rod and fastening it in this position.



A SIMPLE CHIMNEY FLUE CLEANER.

ENGINE FOR MOTOR BICYCLES.

Mr. Maurice Pivert, of 1714 Saratoga Street, New Orleans, La., has recently invented an engine so arranged that it can be conveniently mounted on the frame of a motor bicycle. The engine itself is particularly adapted for rough use, having a very durable construction and being completely dust-proof and not liable to leak or get out of order easily. As shown in our illustration, the casing *A* is made of a single casting, the open end being closed by a cover *B* bolted thereto. The joint is made dust-proof by a gasket compressed between the adjacent edges of the casing and cover. The upper portion of the casing forms a cylinder in which the piston *C* reciprocates. This is connected by a pitman *D* with a wristpin extending between the flywheels *E*. At the upper end of the cylinder there is a side chamber for the admission and exhaust valves, *E* and *F*. The spark plug projects into this chamber between the valves, but is not shown in our illustration. The spark plug is protected from the splashing of oil or dirt, due to the action of the piston, by a shoulder *K* which projects outward over the piston at the top; the sparking plug is thus kept clean, and properly functions at all times. A compression cock *H* is screwed into the cylinder at the top. Near the top of the casing an eyebolt is secured, and this, together with a similar eyebolt formed on the side of the casing at the bottom, affords means for mounting the engine securely to a bicycle frame, as shown in the outline illustration. The engine may also be secured in other convenient positions, as will be readily apparent to our readers.



METHOD OF ATTACHING THE MOTOR. ENGINE FOR MOTOR CYCLES.

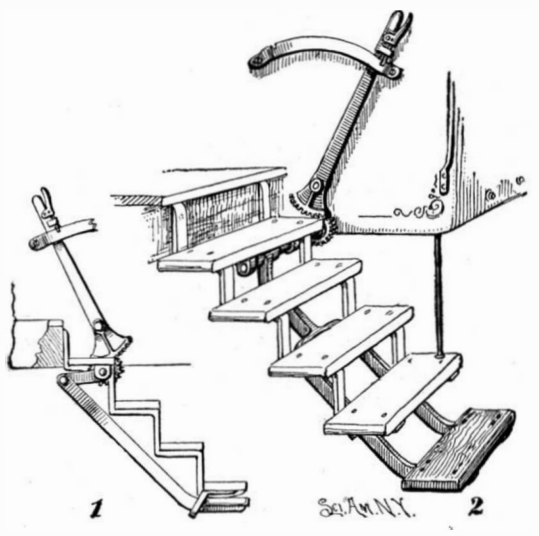
British Inventiveness.

The annual report of the Comptroller-General of Patents states that the number of applications for patents in 1902 was 28,976, compared with 26,777 in 1901, while 8,510 complete specifications were filed after provisional specifications, compared with 7,622 in the previous year. In all, 37,846 specifications were received against 34,410 in 1901, and 13,764 were sealed, an increase on the year of 102. The number of applications by women was 609, of which about two hundred were connected with articles of dress and 127 related to cooking and domestic economy. Of the applications received 17,627 came from England and Wales, 3,549 from the United States, 2,866 from Germany, 1,459 from Scotland, 1,001 from France, 376 from Ireland, and 176 from Canada. A large increase is noticeable in patents for motor-cars, the improvements claimed being chiefly in connection with the driving and other gear and the arrangements of the cars themselves. Much attention was directed, as in the previous year, to wireless telegraphy, and other favorite subjects of invention were golf balls and clubs and reversible outside seats for tramcars. The fire in the city of London on June 9, 1902, on the premises of the General Electric Company, Ltd., whereby ten lives were lost owing to the insufficient length of the escapes, led to a large increase in the applications for fire-escape patents, but this only lasted for a short time. So far as can be judged by the titles of applications, the coronation, with its accompanying events, did not appreciably affect the course of invention.

The number of designs applied for during the year was 17,825, against 16,934 in 1901, and of this number 17,106 were registered, against 16,217 in the previous year. The figures relating to trademarks also showed an increase, being 8,899 applications and 3,404 registrations, against 8,775 and 3,246 respectively in 1901.

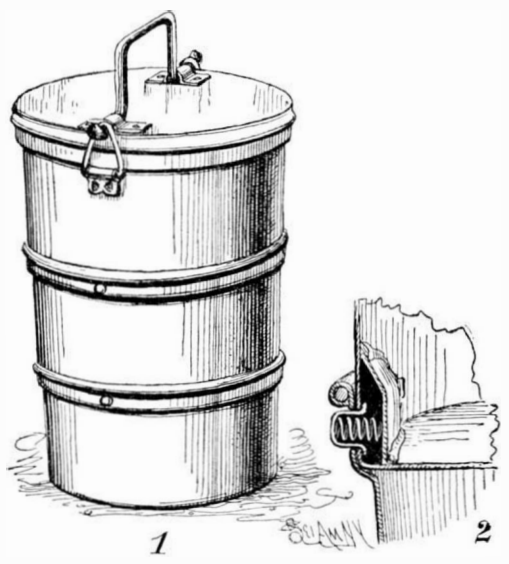
ODDITIES IN INVENTIONS.

Attachment for Car Steps.—The lowest step of a railway car, while properly placed for depots having raised platforms, is entirely too high for the platforms of most stations. On this account the trainmen of the more important trains are obliged to carry a cricket or portable step, to assist the passenger in mounting or dismounting from the first step of the car. An inventor has recently improved upon this primitive system by providing a car step which may be lowered for use or folded out of the way according to requirements. The step is shown in Fig. 1 in its retracted position, which is maintained while the train is in motion. When the train reaches the station, the trainman throws a lever outwardly, which operates through a simple mechanism, such as that illustrated, to thrust the step forward into position for passengers in mounting to reach the fixed steps without undue effort.



ATTACHMENT FOR CAR STEPS.

Nestable Pail.—A resident of Buffalo, N. Y., has invented a pail which can be increased in capacity at will by simply adding to it any desired number of pail sections. Each pail section is virtually a complete pail in itself. The upper end of each section is formed to overlap the bottom of the section above. Near the bottom of each section, and placed diametrically opposite each other, are two spring buttons, which are adapted to snap into corresponding openings in the overlapping portion of the pail section below. The pails may be easily detached by pressing these buttons inward. A cover is provided for the uppermost pail sections, to which a handle is attached. Fastening devices are secured on the pail, which may be snapped over the projecting ends of the handle, which may then be used to lift the assembled pail.



NESTABLE PAIL.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CANE-HARVESTER.—G. D. LUCE, New Orleans, La. The inventor of this mechanism for harvesting sugar-cane has for his object the provision of a machine by means of which the cane may be rapidly cut close to the ground, topped, and stripped. The machine also embodies means for discharging the stalks into a cart or wagon drawn alongside of the harvester.

CANE-FORK.—L. B. LOTZ, Plaquemine, La. In the operation of this device for handling canes, such as sugar-canes, a tripping-line is drawn upon to lift a bail out of engagement with a carrying-hook, releasing the hook, which swings by the weight of the fork and its contents, and releasing the fork, which drops by gravity and discharges the cane. It is then only necessary to lower the fork to the supply of cane, engage it, and readjust the parts to a locked position and then proceed as before.

HAY OR COTTON PRESS.—R. HAMILTON, Commerce, Texas. Broadly stated, this invention consists in a press mounted on wheels, adapting it to be hauled along in a windrow in position to receive hay picked up with a fork by a man walking on the windrow side of the press. Further, it consists in peculiar operating means located on the other side of the press in position adapted to be worked by the driver.

Hardware.

FAUCET.—F. H. HAVEKOTTE, Cincinnati, Ohio. This gate-faucet improvement is of that class where gate devices are used in connection with heavy or semisolid liquids. In faucets of this sort difficulties occur, and the inventor provides means for securing a gate against accidental and fraudulent opening by supplying a lock device for the gate which with the aid of a key may be thrown into action, thus preventing the gate from being opened. When opening the gate a slight application of the key releases the lock.

Mechanical Devices.

VARIABLE-SPEED MECHANISM.—A. A. DE LOACH, Atlanta, Ga. This variable-speed mechanism is particularly adapted for automobiles, engine-lathes, and various other forms of light machinery. The invention provides for a minute adjustment of speed by the same mechanism, both changes being effected without jar or serious strain.

LATHE.—L. J. SHEAD, Defiance, O., and F. J. SHEAD, Chicago, Ill. The object in view in this invention is the provision of a device for more easily and quickly securing on the spindle of a pail-lathe and releasing therefrom pails or similar articles to be turned off on their exterior surfaces and for quickly and easily removing from the article to be turned the truss-hoop in which the rough staves are assembled and temporarily held.

CHURN.—M. F. STILL, Lapanza, Cal. This improvement consists in the construction and arrangement of the churn-body, its supporting-frame, and actuating mechanism, whereby a simple, economical, and compact power-churn is provided in which the churn, the power mechanism, and frame are so combined as to constitute a single unitary organization, the parts being coordinated to and adapted to each other.

Medical Inventions.

SYRINGE.—J. H. SHEETS, New York, N. Y. The arrangement of this implement permits of conveniently filling the barrel with fluid and carrying the syringe about in a pocket, case, or the like, and allows the user to eject any desired portion of the fluid and safely retain the remainder in the barrel for future use.

SECTIONAL CORN-PLASTER.—W. MAHLER, New York, N. Y. This corn or bunion plaster is arranged to allow its ready use for shielding corns and bunions of various sizes and shapes without danger of pressure on any part, thus avoiding the pain caused by ordinary ring-shaped plaster, which is liable to press on the edge of a corn or bunion and crowd it into the central aperture of the plaster.

INVALID-BED AND COMMODE ATTACHMENT.—W. C. FEELY, New York, N. Y. The bed is made in telescopic sections and means are provided for adjustably and removably supporting a commode beneath so that when the bed sections are closed together the commode-support will be under the head-section. This enables the commode to be readily placed upon the support or removed, and when the sections of the bed are separated the commode will be brought into direct contact with the patient in position for convenient use. Each section is provided with independent springs and mattresses.

Vehicles and Their Accessories.

MOTOR-VEHICLE.—J. D. HARP, Modesto, Cal. The invention in the present case has reference to a new and improved motor-vehicle, and the object more particularly in view is to provide a turning-gear upon the axle to which the driving power is applied for the purpose of propelling the machine.

Miscellaneous.

FOUNTAIN-INKSTAND.—F. N. DORLAND, Humboldt, Neb. In carrying out the present invention Mr. Dorland has had in view the provision of a simple, useful, and economic article affording a shallow dip-chamber which supplies just the right depth of ink for properly wetting the nibs and slot of a pen, which allows the ink to flow readily into a reservoir and the air to escape therefrom during the operation of filling the stand, which may be easily and quickly washed out in all its parts, which supplies all the ink contained in the reservoir to the dip-chamber, and in which the ink is stored so that dust and dirt cannot have access to the reservoir.

HOG-TRAP.—M. SAGE, McLean, Ill. Embodied in this invention are new and useful improvements relating to traps for receiving and holding hogs for nose-ringing or other purposes, the object being to furnish a portable hog-trap of simple construction that will operate quickly and that may be adjusted to hogs of any size.

BUREAU-TRUNK.—N. BARUCH, New York, N. Y. The particular object of this inventor is to produce a trunk which is practically convertible into a bureau and suitable for use more especially for traveling men, such as drummers, actors, clergymen, etc. The bureau portion may be used in connection with any desired type of trunk.

TROLLING-SPOON.—A. W. WILSON, San Francisco, Cal. Improved means are embodied in this device for connecting the hooks with a spoon and swivel. Heretofore this connection has been effected by means of faulty construction, but avoided in this invention by providing a connecting-link easily applied to the spoon, so as to hold the hooks properly and with much greater strength than in the old construction.

HEAD AND BACK REST FOR BEDS.—W. C. FEELY, New York, N. Y. The purpose of this contrivance is to provide a rest adapted to any form of metal bedstead and which can be readily adjusted longitudinally of the bed to and from the headboard at any inclination and securely held in position; and to so construct the head-rest that it may have a solid or yielding support for the back and head and be compactly folded out of the way against the headboard when not in use.

WINDOW SASH AND FRAME.—G. B. DETERMANN, Louisville, Ky. The invention in the present case refers to a window sash and frame constructed wholly of sheet-iron or other metal in such a manner as to make the construction durable and inexpensive and to insure against destruction by fire. By means of this improvement a building may be rendered entirely fireproof.

DOMESTIC REFUSE CREMATORY.—J. H. COTTER, Winnipeg, Canada. The objects in this case are to provide means to expose a large area of refuse to an incandescent bed of fuel, to allow the refuse to be partially embedded in the fuel-bed in opposition to a mere suspension thereover in order to secure better results, to provide for the ingress of air to the burning refuse so as to support combustion, and to provide means by which a vertical play is permitted to the refuse-container that it may sink into the bed of fuel as the latter is consumed.

NON-REFILLABLE BOTTLE.—B. CLEMENS, Moundsville, W. Va. The object claimed by this inventor is the production of a bottle which, if not literally non-refillable, will make refilling so tedious and difficult as to be unprofitable, while at the same time the parts will have such a conformation and arrangement as to enable the bottle to be manufactured by the usual methods.

CABINET.—S. C. PRICE, Pittsburg, Kan. This cabinet enables one to utilize the entire space along the wall from the floor to the ceiling without using a step ladder or other means for climbing up to points near the ceiling. This is attained by an arrangement of balanced cases placed in pairs, one to move up as the other moves down, and thus while they may be placed one higher than the other for display, when it is desired to remove the goods either of the cases may be lowered convenient for a person standing on the floor.

WAIST-BELT.—L. SANDERS, New York, N. Y. The intention in this case is to construct a belt to neatly fit the waist and to provide the rear of the belt with a downwardly-extending outwardly-flaring skirt member at the back adapted to fit snugly to the rear of the person just below the waist-line to add to the graceful appearance of the belt at the back and to cover any space that may occur between the waist and skirt by reason of sagging and separating.

MUSIC-LEAF TURNER.—W. BALKO, New York, N. Y. The object of this contrivance is to provide a new and improved music-leaf turner which is simple and durable in construction, easily set into an active position, and arranged to enable the performer to readily and periodically actuate the device for turning the leaves at the proper time and in regular order.

BASE-BALL BAT.—J. F. MCCOY, New Orleans, La. This new and improved base-ball bat is not liable to break when in use and it is arranged to readily flex or spring between the handle and butt to allow driving the base-ball with great force and speed and to a greater distance than heretofore possible with ordinary solid bats.

FLOOR CONSTRUCTION.—A. DE MAN, New York, N. Y. The particular object in view in this improvement is to provide a new floor construction preferably made of fireproof material and arranged to span large bays without the use of floor-beams and at the same time produce a flat ceiling and render the floor soundproof.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 4326.—For makers of pour-out bottle stoppers for quart and pint ink bottles.

Morgan Emery wheels. Box 517, Stroudsburg, Pa.

Inquiry No. 4327.—For makers of mucilage caps.

"U. S." Metal Polish. Indianapolis. Samples free.

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Inquiry No. 4330.—For independent sandpaper manufacturers.

Metal working dies and novelties manufactured by Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No 4331.—For makers of small, galvanized tubing.

Mechanics' Tools and materials. Net price catalogue. Geo. S. Comstock, Mechanicsburg, Pa.

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Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 4333.—For makers of outfits for making rubber stamps.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 4334.—For makers of kneading machines, biscuit or cracker cutters, bake-ovens, etc.

FOR SALE.—Patent. Means for converting an automobile into a sleigh. Max Abraham, Yonkers, N. Y.

Inquiry No. 4335.—For makers of telephone outfits.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 4336.—For a rotary power of 2 or less run by compressed air.

WANTED.—Addresses of firms making small steel and brass nuts, rods, etc., in ten thousand lots. R. E. Hardy, 26 Cortlandt Street, New York.

Inquiry No. 4337.—For hand power machines for the treatment of gold-bearing sands.

Crude oil burners for heating and cooking. Simple, efficient and cheap. Fully guaranteed. C. F. Jenkins Co., 1103 Harvard Street, Washington, D. C.

Inquiry No. 4338.—For makers of small armature disks and stampings for the stator and rotor of small induction motors.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 4339.—For a machine for putting top, bottom and side labels on a one ounce box.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 4340.—For an instrument called the "acidimeter."

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 4341.—For a machine for tying bristles or rattan for brushes and brooms.

Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

Inquiry No. 4342.—For dealers in brush material and rattan.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $5. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 4343.—For isinglass in large sheets.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 4344.—For dealers in gold-beaters' skin.

WANTED.—To lease two 40 to 50 ton six wheel, or eight wheel or ten wheel, or Mogul locomotives. Send general dimensions and report on conditions with proposition. Georgia Iron and Coal Company, Chattanooga, Tenn.

Inquiry No. 4345.—For makers of incubators.

FOR SALE.—Patent rights in the United States of Wells' Chromatrope, patented June 9, 1903, No. 730,501. An original, amusing, beautiful and scientific invention. Best of advertising mediums. A sure money maker. Electrical novelty. People do not miss this chance. For further particulars address George Wells, Inventor, 25 Cuthbert Street, Montreal, Canada.

Inquiry No. 4346.—For makers of oval sheet iron trays, also for jobbers handling wire-woven fabric or ribbon used behind waxed paper on typewriters.

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Inquiry No. 4347.—For makers of collapsible metal tubes.

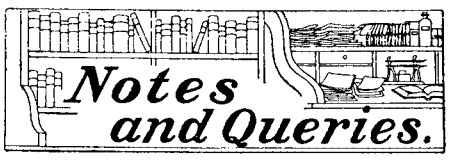
Inquiry No. 4348.—For makers of furniture.

Inquiry No. 4349.—For makers of peat-compressing machinery.

Inquiry No. 4350.—For makers of the India oil stove for carpenters.

Inquiry No. 4351.—For makers of machinery for making eyelets for bails, etc.

Inquiry No. 4352.—For makers of aluminium wash boilers.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Minerals sent for examination should be distinctly marked or labeled.

(9063) J. C. R. asks: Will you explain the following experiment? I set the front wheels of a bicycle in motion and then I placed one end of the axle on my first finger. The result: While it revolves on its axle it also tends to revolve in an orbit around me. If you revolve it with the axle vertical, it tends to revolve in an orbit as before. A. The bicycle wheel in your experiments is a form of gyroscope and revolves as this instrument does. You will find it explained in Hopkins' "Experimental Science," where many forms of the gyroscope are illustrated.

(9064) W. M. F. says: Please inform me what would take away the echo from a hall which is on the third floor of a building. I do not want to use a sounding-board, as it is too expensive. I have inclosed a small plan of the hall. A. We do not think a sounding-board would assist the acoustics of your hall. It is just as bad as a hall can be; a square box with a curved ceiling (if we read your drawing aright) and with a hard wall. An abundance of soft hangings along the side walls, such as heavy curtains upon poles, as if there were windows in the wall, is advisable. Such echoing halls are often much improved by stringing fine wires across them, several feet above the heads of people; in your hall this might be done nine feet above the floor. Another decoration can be added which would deaden the noises, by putting up an abundance of bunting or cheesecloth from the center of the ceiling to the sides and corners as when the hall is dressed for some patriotic occasion. A gallery with rising rows of seats would assist much in breaking up waves of sound. You cannot hope to destroy the echoes except by such means as these. The idea is to replace the hard surfaces of the wall by soft and yielding materials, and to break up the rectangular character of the room, and particularly the vaulted ceiling, as much as possible.

(9065) L. S. M. writes: I am a student in engineering at the University of Pennsylvania, and in looking over Notes and Queries noticed the statement made in answer to query No. 8979, that "There is no possible way in which a man can do one horse power work for even a moment." Also, "A man's power does not much exceed 70 foot pounds per second." I would like to state that this answer is in error, and to illustrate by a familiar example, the horse power that an average man is capable of exerting. A man in walking upstairs, at an average rate of speed lifts his weight 1¾ feet per second; thus, a man of average weight, say 160 pounds, is doing 160x1¾ or 280 foot pounds per second. As 550 foot pounds per second is one horse power, the man exerts more than ½ horse power, without undue exertion. By running upstairs the same man can lift his weight 3½ feet per second, thus doing 160x3½ or 560 foot pounds per second, or more than a horse power. The truth of these statements can be easily verified by any of your readers. A. The figures we gave for a man power were derived from Kent's "Mechanical Engineering Pocket Book," and may be taken as reliable. We deem it certain that an average man cannot take 560 pounds of iron and raise it one foot per second, even though he might run upstairs at the rate you state for a few seconds. Sandow perhaps does a horse power of work for a time, but such facts do not vitiate our statement as we understand it. The turning of a dynamo machine is not the same as running upstairs. We do not believe an average man can bring the eight-light dynamo to full current even for a moment.

(9066) J. D. asks: 1. The first sheet of tinfoil in a condenser has a lug on the right; over this sheet is placed a sheet of insulated paper and then a sheet of tinfoil with a lug on the left. I cannot understand how there is a circuit. I find there is. A. A condenser is put together as you describe. There must not be any *circuit* through it. It would be of no use whatever if a metallic path were made through the sheets of foil. If you have a circuit, the condenser should be opened and rebuilt with better insulation between the sheets. 2. Is it advisable to put a fuse (and if so, what size) outside the window—where the vertical is brought into the coherer? A. A lightning arrester should be put into the

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circuit of the vertical wire before it is brought to the coherer. 3. Can a good ground be made by going down 4 or 5 feet and filling the hole with good conducting material? Should the ground be very dry below this depth, would the above labor be in vain? How would a zinc can 3½ inches high filled with moist earth do? In this country you must go to the ocean or a water pipe. The ground is no good as a conductor. A. By a "good ground" is meant a ground permanently moist. Nothing else will answer. The connection had better be run to water, even if the distance is great.

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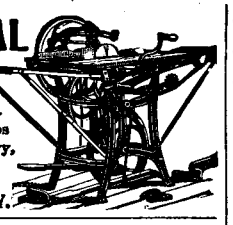
WOOD or METAL Workers



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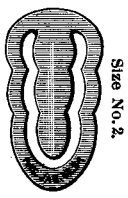

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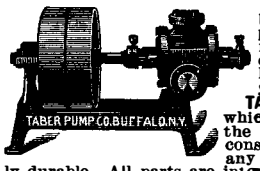

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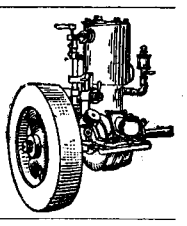

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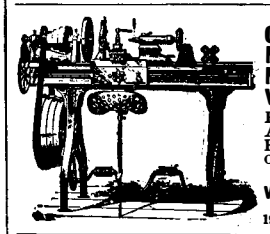

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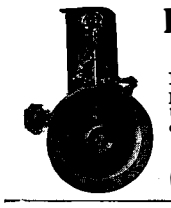

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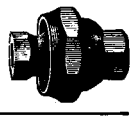

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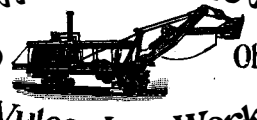

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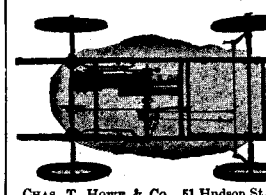

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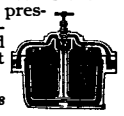

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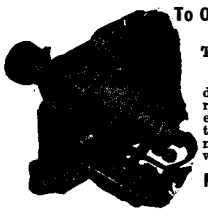

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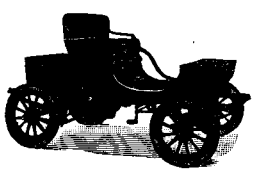

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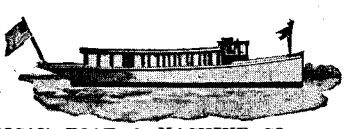

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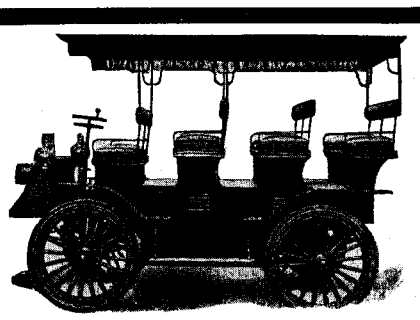

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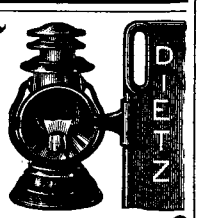

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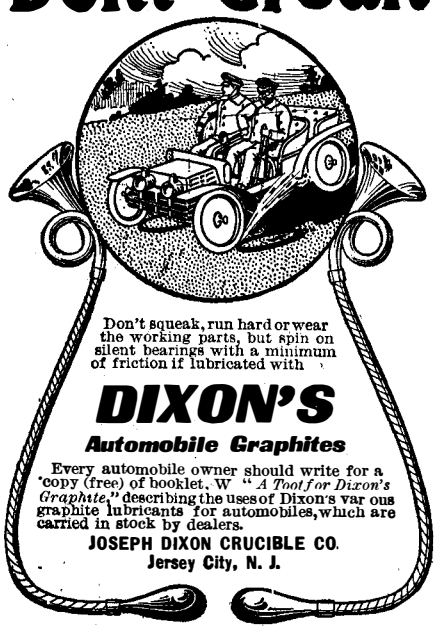

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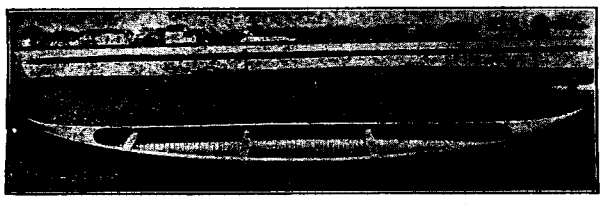

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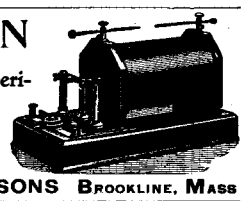

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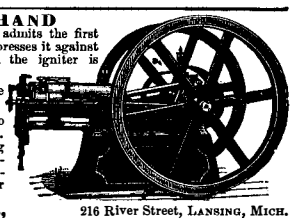

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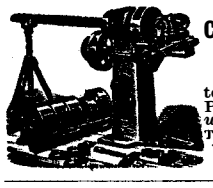

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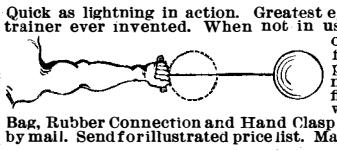

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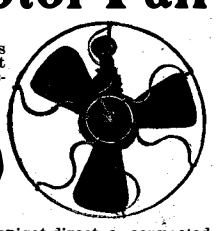

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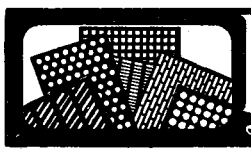

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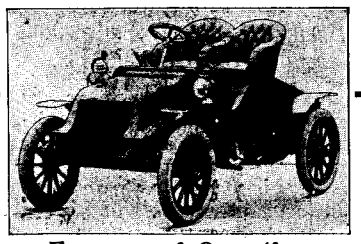

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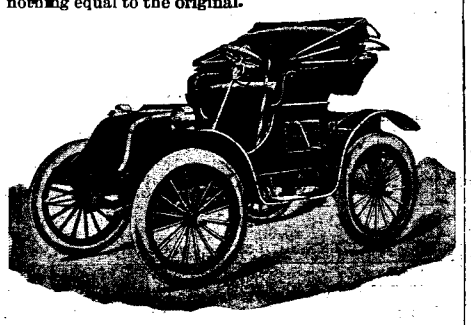

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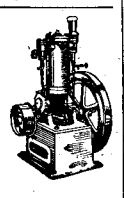

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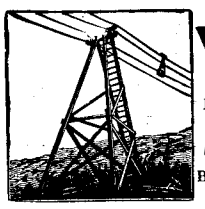

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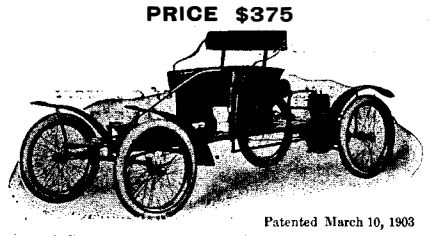

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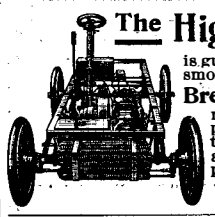

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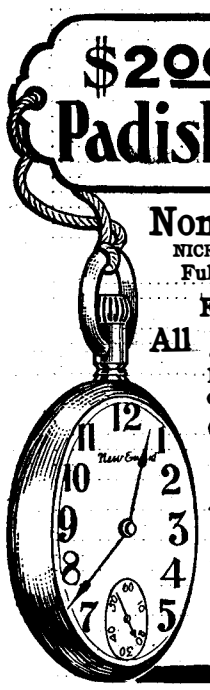

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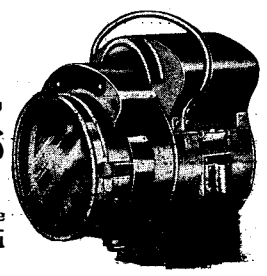

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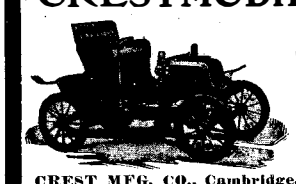

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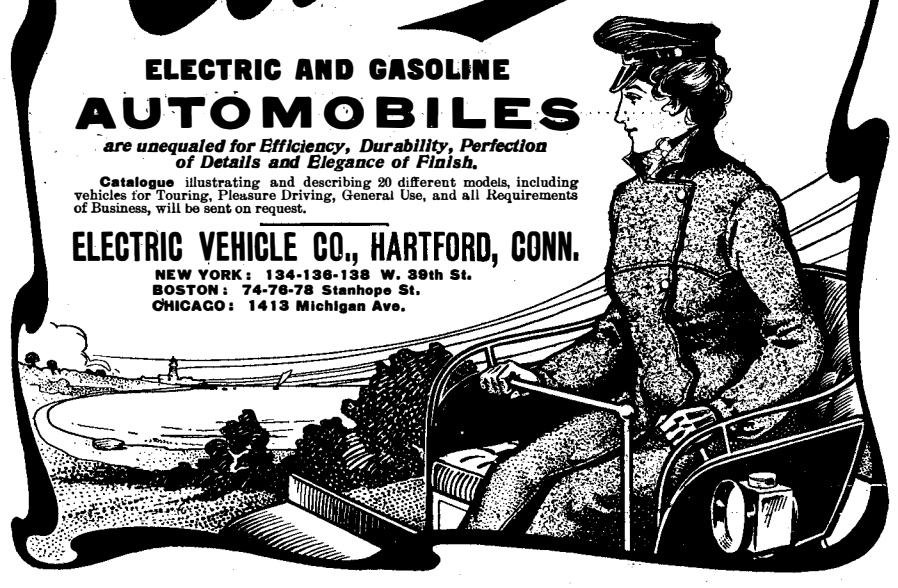

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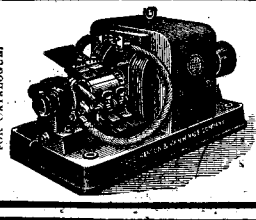

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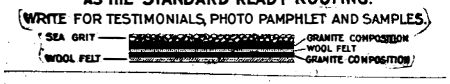

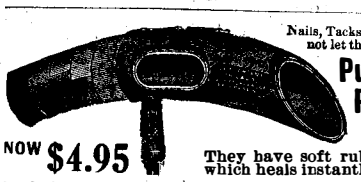

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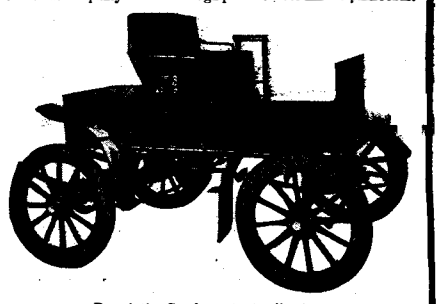

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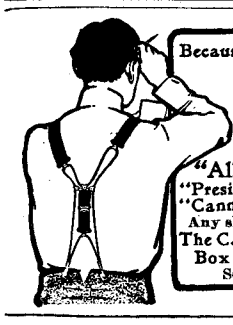

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